Monitoring of surface water, sediment, and ground water will be conducted to verify that contaminants are not migrating and ensure the beneficial use of these resources. Implementation of the remedy should be completed within 3 years and allow return of the Mine site (with the exception of the mine waste repository and pond) to the anticipated future use of recreation, grazing, and timber production. Riparian habitat in the meadow will also be restored. Short-term impacts during the period of implementation are minimal and do not persist throughout the entire year due to snowfall and limited access to the Mines site.

The baseline ecological risk assessment predicted adverse impact to aquatic invertebrates exposed to non-radionuclide contaminants in the White King pond sediments. The greatest risks were associated with the arsenic in sediments (HI of 33). Historically very little aquatic life has inhabited the White King pond. This is probably due to a number of factors including low pH and elevated sediment arsenic levels. Increasing the pH in the White King pond and further evaluation of the sediments will help to determine what future beneficial uses of the pond are achievable. If the data verifies that sediments pose an unacceptable risk to aquatic organisms at the population level which could impact higher trophic levels, additional action such as sediment capping or dredging may be required. This action would be documented in an ESD or ROD amendment.

12.6.1 Remediation Levels

Numerical cleanup levels have been established to address the primary risk drivers and the RAOs discussed in Section 8.0. These values will be used to guide soil excavation and ensure that the source control measures being taken are effective in preventing migration of contaminants into other media. Due to the natural mineralization in the area of the site preliminary background levels are higher than either risk based levels or applicable standards, and are therefore the basis for most of the cleanup levels discussed below. **Further refinement of all media background values will be conducted as part of the remedial design and remedial action.**

White King Stockpile

For the Mines site stockpiles and soils EPA used ODEQ's cleanup law (ORS 465.315 and implementing regulations at OAR 340-122), which establishes standards for cleanup based on acceptable risk levels or background concentration, whichever is higher. At the White King Mine, background levels are higher than the protective levels, due to the natural mineralization in the area, and therefore were used to establish excavation levels. EPA and DEQ policy is to remediate to background, regardless of the risk from exposure to background concentration. Based upon EPA's determined subsurface background at White King the remediation levels shown in Table 12-1 apply to excavation into the surface and subsurface. Clean fill will be added to the surface or excavation after removal of the stockpiles, in order to meet surface soil background concentrations. Surface soil background levels will be established during the remedial design.

Table 12-1 White King Soil Remediation Levels

Area of Site	Chemical	Remediation Level	Basis for Remediation Level

White King Soils	Arsenic	442 mg/kg	Background (95% UTL lognormal subsurface soils - under and near pile locations omitted)
	Radium-226	6.8 pCi/g	Background (95% UTL normal subsurface soils - under and near pile locations omitted)
Because arsenic is an intrinsic component of mineralization at the White King mine, cleanup for radium-226 to background will assure that arsenic, thorium-230 and uranium-234 and -238 also will be removed.			

White King Pond Water

The remediation level for arsenic, the primary COC in the pond water, is shown in Table 12-2. Remediation levels would typically be based on surface water quality standards or pond surface water background values, whichever is less stringent. Since the pond was created by mining activities, a background value, as that term is used by EPA, is not available for the pond. Since the pond water is primarily derived from ground water the discharge from ground water to surface water should meet surface water background concentrations since background is higher than the applicable standard or protective level. Therefore, the value shown below is based on the Augur Creek surface water background levels. A remediation level for pH has also been established to guide the neutralization actions being taken on the pond. This value is based on the goal of meeting Oregon's State water quality standards (OAR 340-41-925). Further monitoring and evaluation of the pond during the remedial action will determine the ability to meet this standard.

Table 12-2 White King Pond Water Remediation Levels

Area of Site	Chemical or Parameter	Remediation Goal	Basis for Remediation Goal
White King Pond	Arsenic	0.033mg/L[a]	95% UTL Background[b]
	pH	7-9	Goose Lake Basin Criteria OAR 340-41-925(2)(d)

[a] Based on total recoverable concentrations in water

[b] 95% UTL normal distribution upgradient of White King pond (value may be elevated due to an outlier)

White King Pond Sediment

As a result of limited information on the arsenic concentrations in sediment, and the unknowns associated with long term pond neutralization, numerical cleanup goals for sediment have not yet been established. After a period of investigation and evaluation described in Section 12.2 remediation goals will be selected that will be protective of the beneficial use.

Augur Creek Surface Water

Active remediation of surface water is not required in Augur Creek in order to achieve protection of human health and the environment. Monitoring of surface water will be conducted to ensure the stockpile remedy is effective and ensure that contaminants are not migrating The remediation levels for arsenic in surface water are based on the Augur Creek background concentration developed during the remedial investigation. By selecting a background level as a goal it is in compliance with the state water quality standards and the state environmental cleanup law. Background is provided for under 340-041-925 (3) of the state water quality rule and under OAR 340-122-040 the state cleanup rules.

Table 12-3 Augur Creek Surface Water Remediation Levels

Area of Site	Chemical or Parameter	Remediation Level	Basis for Remediation Level
Augur Creek Surface Water	Arsenic	0.033mg/L[a]	95% UTL Background[b]

[a] Based on total recoverable concentrations in water

[b] 95% UTL normal distribution upgradient of White King pond (value may be elevated due to an outlier)

Augur Creek Sediment

Some portions of Augur Creek, particularly those adjacent to the White King stockpiles, contain elevated levels of arsenic in sediment from stockpile erosion. The maximum observed background concentration upstream of the White King mine was determined to be 4.2 mg/kg. The lowest effect level for aquatic life, based on the Ontario Sediment Quality Standard, is 6 mg/kg. Since this value is less stringent than background it was selected as the cleanup level for these areas. In the case of Manganese the background value of 1610 mg/kg was less stringent than a protective level of 460 mg/kg (HI=1) and therefore background was selected as the remediation level. A visual cleanup approach as described above for the stockpile soils will be utilized to the maximum extent practicable, followed by verification sampling.

Table 12-4 Augur Creek Sediment Remediation Levels

Area of Site	Chemical or Parameter	Remediation Level	Basis for Remediation Level

Augur Creek Sediment	Arsenic	6 mg/kg (dry weight)	Lowest Effect Level Ontario Sediment Quality Guidelines
	Manganese	1610 mg/kg	Background Highest Upgradient Concentration

Ground water (White King & Lucky Lass)

Active remediation of ground water is not required at the Mines site in order to achieve protection of human health. Institutional controls are being used to restrict use of ground water beneath the stockpiles. (The concentration of arsenic in all downgradient wells are below MCLs). Discharge of groundwater to surface water is the State designated beneficial use. (Under the NCP ground water would be designated as Class II(b). Eventually ground water at the edge of the waste management area should be returned to drinking water standards (the MCL for Arsenic is currently 50µg/l) or background, whichever is less stringent.) In order to protect the aquatic habitat of Augur Creek, the discharge from ground water to surface water should meet background concentrations since background is higher than the applicable standard or protective level. A potential risk was also identified for radon in ground water. Again the area background values are elevated and the basis for the remediation level. (The current proposed MCL for a community water system is 300 piC/L). Monitoring of ground water will be conducted to insure that contaminants are not migrating and insure protectiveness of the designated beneficial use of ground water.

Table 12-5 White King/Lucky Lass Mine Ground water

Area of Site	Chemical or Parameter	Remediation Level	Basis for Remediation Level
Ground water at Edge of Waste Management Area	Arsenic	0.033mg/L[a]	95% UTL Background[b] for Surface Water
	Radon	704pCi/L	95% UTL Background for Ground water[c]

[a] Based on dissolved concententrations in water

[b] 95% UTL normal distribution upgradient of White King pond (value may be elevated due to an outlier)

[c] Value derived from 14 "background" wells identified in the RI

Lucky Lass Stockpile

As with the White King soils EPA used ODEQ's cleanup law (ORS 465.315 and implementing regulations at OAR 430-122), for establishing standards for cleanup based on acceptable risk levels or background concentration. At the Lucky Lass Mine, the cleanup goals are lower that at the White King Mine due to differences in local background levels. The remediation goal for arsenic is 38 mg/kg based on recreational use (the most likely exposure scenario). The radium-226 cleanup

level is 3.6 pCi/g, again based on background levels. The soil cleanup process will begin with gamma screening to identify areas with elevated Radionuclides followed by excavation using a visual criteria as described for the White King stockpile soils. Following soil excavation confirmation sampling and gamma screening will be conducted to verify cleanup.

Table 12-6 Lucky Lass Soil Remediation Levels

Area of Site	Chemical	Remediation Level	Basis for Remediation Level
Lucky Lass Soils	Arsenic	38 mg/kg	$1x10^{-6}$ Protection for Recreational User ORS 465.315
	Radium-226	3.6 pCi/g	Background - 95% UTL normal distribution subsurface soils (without meadow locations)

SECTION 13

STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy, Containment and Consolidation of the White King Stockpiles (SP-3b), Pond Water Neutralization (WKPW-3), and removal of soils exceeding remediation goals at Lucky Lass (LL-3), will protect human health and the environment by:

- Preventing direct contact, including ingestion, dermal contact and inhalation of soils containing COCs above health-based levels
- Restricting access to the contaminated soils through physical and institutional controls
- Neutralizing the acidic water in the White King pond and restricting access to the pond until the risks from pond sediments are more fully evaluated
- Consolidating and covering of contaminated soils to reduce infiltration of COCs into ground water

There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the selected remedy.

Implementation of the selected remedy is not expected to pose unacceptable short-term risks or significant cross-media impacts.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy for the Mines site will comply with Federal and State ARARs that have been identified. No waiver of any ARAR is being sought or involved for the selected remedy. Where a State ARAR is equivalent or more stringent that a corresponding Federal ARAR, only the State ARAR is identified. The ARARs for the Mines site are identified below.

Applicable or Relevant and Appropriate Requirements (ARARs)

CERCLA remedial action is required to comply with applicable or relevant and appropriate requirements (ARARs), unless an ARAR is waived. ARARs for cleanup of the Mines site include statutory and regulatory requirements promulgated by the State of Oregon that address the disposal of radioactive material including uranium mine overburden. Also see Section 10.2.1 for a discussion of this ARAR. These rules require that radioactive material not be located in: certain specified locations which affect some of the stockpiles and the placement of the mine waste repository at the Mines site. The rules include a pathway exemption set forth in OAR 345-050-0035, which exempts certain material from the rules. The Oregon Office of Energy, the agency charged with administering these laws, determined that the floodplain and erosion standards apply to the overburden piles because the gamma pathway set forth in OAR 3450-50-0035 is exceeded. OOE has determined that concentrations of radioactive material in the overburden and protore stockpiles at the Mines site exceed the pathway exemption and therefore are subject to the requirements of this rule. For such disposal, a site is not suitable if it is located in: an area subject to surface water erosion over the projected life of the facility considering historical erosion, ancient shorelines, stream beds and cutting due to floods; a 500-year floodplain of a river, stream or creek considering potential erosion effects; an active fault zone; an area of ancient, recent or active mass movement; an area subject to volcanic damage.

The selected remedy will also comply with the following ARARs:

Federal Endangered Species Act of 1973 (16 USC 1531 et seq., 50 CFR Part 200, 402). This regulation is applicable to any action authorized, funded, or carried out by any Federal agency that could jeopardize the continued existence of any listed species or result in the destruction or adverse modification of habitat of such species. The listed and proposed endangered and threatened species that may occur within the area of the Mines site is the bald eagle, Canada Lynx, and Modoc Sucker. A biological evaluation completed by the Forest Service on 6/15/01 determined no impact or environmental effects from the project on habitat, individuals, a population, or listed or sensitive Therefore EPA has determined the implementation of the selected remedy is not likely to affect the listed species or their designated critical habitat.

Oregon Revised Statute (ORS) Chapter 469.375. (Required Findings for Radioactive Waste Disposal Facility). Under this statutory provision, the Oregon Energy Facility Siting Council (EFSC) shall not issue a site certificate for a waste disposal facility for uranium mine overburden unless certain findings are made. Although a site certificate issued by the EFSC is not required at this site pursuant to CERCLA Section 121(e)(1), portions of this requirement are relevant and appropriate. The remedial action will comply with this requirement by not locating the mine waste repository in an area determined to be potentially subject to river or creek erosion within the lifetime of the facility.

Oregon Administrative Rules (OAR) Chapter 345, Division 50 (Radioactive Waste Materials), Section 60 (Site Suitability). These rules are applicable and govern disposal of radioactive material, including uranium mine overburden. For such disposal, a site is not suitable if it is located in: an area subject to surface water erosion over the projected life of the facility considering historical erosion, ancient shorelines, stream beds and cutting due to floods; a 500-year floodplain of a river, stream or creek considering potential erosion effects; an active fault zone; an

area of ancient, recent or active mass movement; an area subject to volcanic damage. The remedial action will satisfy this requirement because the mine waste repository will not be located in any of these areas. The rules also include a pathway exemption set forth in OAR 345-050-0035, which exempts certain material from the rules however, the Oregon Office of Energy, the agency charged with administering these laws, determined that the concentrations of radioactive material in the stockpiles at the White King mine exceed the gamma pathway set forth in OAR 3450-50-0035. OOE made this determination based on radium-226 concentrations sampled in the stockpiles (OOE's June 21, 2000 letter sets forth the reports of sampling data). OOE compared these concentrations to levels seen at other sites, and concluded that gamma radiation at the White King overburden and protore stockpiles would result in exposures exceeding 500 millirem per year. Because the exemption does not apply, the remedy will comply with these requirements.

Water Pollution Control Laws (ORS Chapter 468B) and Oregon Stormwater Standards (ORS Chapter 468B.025). Although the administrative permitting requirements of this provision are not applicable to the Mines site, the substantive stormwater protection requirements are relevant and appropriate. The 468 requirements address effluent standards, substantive permit requirements for discharges to U.S. waters, and minimum Federal water quality criteria. The remedy will meet these requirements by consolidating the stockpiles with a cover and native vegetation, and treatment of the White King pond water. Monitoring will be conducted on surface water to ensure the remedy meets these requirements. The 468B requirements address any construction activity that disturbs more than 5 acres. Although a permit is not required at the Mines site pursuant to CERCLA Section 121(e)(1), the substantive provisions of Oregon's NPDES general permit 122-E will apply. The remedial action will meet these requirements through preparation of an erosion and sediment control plan during the design. This plan will use best management practices to prevent discharge of significant amounts of sediment to surface waters in order to comply with water quality standards in OAR 340-41.

Clean Air Act, 42 U.S.C. §§ 7401 et seq., (CAA), National Ambient Air Quality Standards (NAAQS) 40 CFR. Part 50; Oregon implements the Federal Clean Air Act requirements and ambient air standards. These regulations are applicable for control of dust particles emitted into the air during remediation construction activities. The selected remedy will meet these requirements by using dust control measures while excavating the stockpiles.

Oregon Environmental Cleanup Law, Oregon Revised Statute (ORS) Chapter 465.315; OAR Chapter 340 Division 122 (Hazardous Substance Remedial Action Rules). These rules are applicable for the establishment of cleanup levels and selection of remedial actions. OAR 340-122-040(2) requires that hazardous substance remedial actions achieve one of four standards: a)acceptable risk levels, b) generic soil numeric cleanup levels, c) remedy-specific cleanup levels provided by ODEQ as part of an approved generic remedy, or d) background levels in areas where hazardous substances occur naturally. The risk based and background levels are applicable to the Mines site.

OAR 340-122-115 defines the following maximum acceptable risk levels:

- 1×10^{-6} for individual carcinogens
- 1×10^{-5} for multiple carcinogens, and
- a Hazard Index of 1.0 for noncarcinogens

These acceptable risk levels were used as a basis to establish soil remedial goals for the Mines site, taking into account the current and reasonably likely future land use, as presented in Section 6. These remedial goals are applicable to soil at the Mines site where COC concentrations in soil exceed the remedial goals and background and will be achieved through a combination of soil hot spot removal, consolidation and covering, and institutional controls.

OAR 340-122-085(7) requires that, for hot spots of contamination in media other than ground water or surface water, the feasibility of treatment be evaluated. This evaluation is discussed further in Section 11.

Further assessment of the White King pond will determine the effects of arsenic on aquatic invertebrates. Additional action, if determined to be necessary, to address unacceptable risk levels in the aquatic environment will be documented in an ESD or ROD amendment.

OAR Chapter 345, Division 92 (Standards for the Siting of Uranium Mills), Section 31(1) (Standards Relating to Public Health and Safety of Uranium Mill Operation, Decommissioning and Waste Disposal). This regulation establishes standards that applicants must meet to obtain a site certificate for uranium mills and related and supporting facilities, which includes any site for the permanent disposal of mine overburden. This regulation is not applicable to the remedial action because it applies to an application to prospectively construct and operate a uranium mill and supporting facilities. However, this regulation is relevant and appropriate because it establishes allowable radiation equivalent criteria for any member of the public, criteria for release of airborne effluents and protection criteria for population doses. The remedy will meet these requirements by covering the stockpiles and reducing radiation exposures to below the levels established under these requirements (25 millirems to whole body, 75 millirems to thyroid, etc).

OAR Chapter 345, Division 95 (Construction, Operation and Decommissioning Rules for Uranium Mills), Section 90 (Public Health Impacts). This regulation applies to uranium mills and related and supporting facilities operated pursuant to a site certificate agreement. It is relevant and appropriate because it establishes allowable radiation equivalent criteria for any member of the public, criteria for release of airborne effluents and protection criteria for population doses. The remedy will meet these requirements by covering the stockpiles and reducing overall radiation exposures.

36 CFR Part 228 (Minerals), Section 8. These regulations are intended to minimize adverse environmental impacts on National Forest Service System surface resources in connection with operations authorized by Federal mining. In addition to requiring compliance with applicable air quality, water quality, and solid waste standards, this section requires that operators, to the extent practicable, harmonize operations with scenic values through construction of structures which

blend with the landscape, take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by operations, construct and maintain all roads to assure adequate drainage and minimize damage to soil, water and other resource values, and reclaim the surface disturbed in operations by controlling erosion, landslides, and water runoff, isolating, removing or controlling toxic materials, reshaping and revegetation of disturbed areas where reasonably practicable, and rehabilitating fisheries and wildlife habitat. This section is relevant and appropriate to the remedial action at the Mines site. The selected remedy will meet these requirements by excavating and consolidating stockpiles to blend with the natural contours at the Mines site. Placement of a soil cover and establishment of vegetation on the stockpiles will also prevent erosion and reduce infiltration which will protect Augur Creek and its associated wetland habitat. Neutralization of the White King pond may allow the establishment of a diverse aquatic community which will enhance and protect this habitat.

Oregon Administrative Rules, Chapter 345, Division 95 (Oregon Construction, Operation and Decommissioning Rules for Uranium Mills) Section 118 (Mine Reclamation). Because this regulation applies to uranium mills and related and supporting facilities operated pursuant to a site certificate agreement, it is not applicable to the remedial action. However, it is relevant and appropriate because it requires that a mine site be reclaimed by modifying overburden and waste dump slopes to grades favorable to reclamation, implementing surface water management measures to prevent water collection or erosion in the area and to aid in revegetation of the site.

Oregon Administrative Rules, Chapter 632, Division 30 (Oregon Mined Land Reclamation Action) Section 27 (Minimum Standards for a Reclamation Plan). These rules prescribe procedures for obtaining an operating permit and complying with other requirements of the Oregon Mined Land Reclamation Act. Although a permit is not required at the Mines site pursuant to CERCLA 121(e)(1), portions of the substantive requirements are relevant and appropriate. A reclamation plan is not required to be submitted, although the remedial design will address certain minimum standards of a reclamation plan.

Migratory Bird Treaty Act (16 USC 703 et seq.). The Migratory Bird Treaty Act makes it unlawful to "hunt, take, capture, kill" or take various other actions adversely affecting a broad range of migratory birds, including mallards, ravens, juncos, nuthatchs, chickadees, and sandhill cranes (see 50 CFR 10.13) for a list of protected migratory birds) without prior approval by the Department of the Interior. This statute and implementing regulations are relevant and appropriate for protecting migratory bird species identified at the Mines site. The selected remedies will be carried out in a manner that avoids taking or killing of protected migratory bird species, including individual birds or their nests.

Other Criteria, Advisories, or Guidance To-Be-Considered (TBCs) for this remedial action

Additional policies, guidance, and other laws and regulations considered in the selection of the remedy, or which impact the remedy include the following:

Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 C.F.R §192, Authority: Sec. 275 of the Atomic Energy Act of 1954, 42 U.S.C. §2022, as added by the Uranium Mill Tailings Radiation Control Act of 1978, Pub. L. 95-604, as amended.). This rule provides general design standards for cleanup and disposal of uranium tailings from inactive uranium processing sites as well as regulations to correct and prevent contamination of ground water from these sites. Because mine wastes are radiologically and geochemically similar to tailings, this standard is "to be considered" in design of the mine waste repository and soil cover.

International Atomic Energy Agency (IAEA) Guidelines (Technical Report Series No. 335). This document provides current practices used in design, siting, construction, and closeout of impoundment facilities for uranium mill tailings. Because the Mines site does not contain mill tailings, these guidelines are not directly applicable to the selected remedy. However, given the similarity between the wastes at the Mines site and those discussed in these guidelines and the similar goals they are "to be considered" in the design of the mine waste repository and soil cover.

The EPA action level of 4.0 pCi/l of indoor radon is commonly recognized by Federal (and ODEQ) agencies as an upper limit on radon exposure in the home. This is equivalent to 0.02 WL (Lung Cancer Risk from Indoor Exposures to Radon Daughters, Internal Commission on Radiological Protection (ICRP) Publication 50, 1987, Pergamon Press, Oxford). The selected remedy will meet these levels by covering the stockpiles and preventing future residential use of the Mines site. Post construction monitoring of the mine waste repository will be conducted to confirm compliance with these levels.

U.S. Water Quality Criteria, 1986

The water quality criteria are standards for ambient surface water quality. These criteria present guidance on the environmental effects of pollutants that can be a useful reference in environmental monitoring. These criteria are "to be considered" in monitoring surface water at the Mines site and evaluating remediation levels.

13.3 COST-EFFECTIVENESS

The selected remedy is determined to be cost-effective. In making this determination, the following definition set forth in the NCP was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (40 CFR §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (*i.e.*, were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine

cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent.

The estimated present worth cost of the selected remedy is as follows:

Alternative SP-3b (stockpiles): $6, 625,376
Alternative LL-3 (Lucky Lass): $535,000
Alternative WKPW-3 (White King Pond): $740,000

13.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Mines site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering State and community acceptance.

13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy utilizes alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. The remedy for the White King Pond, in-situ neutralization, satisfies the statutory preference for treatment as a principal element of the remedy. Neutralization of the pond water increases the pH and reduces the concentration of COCs in the surface water. Treatment of the remaining threats, stockpile soils, was not found to be practicable due to the large volume.

13.6 FIVE-YEAR REVIEW REQUIREMENTS

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

SECTION 14

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan was released for public comment in October 1999. It identified Alternative SP-3b as the preferred alternative for the White King stockpiles which included recontouring of the protore stockpile, consolidation with the overburden stockpile, a 24-inch rock/soil cover, and a 20-foot setback from Augur Creek (excavation of 33,000 cubic yards). Comment was received from OOE indicating that Alternative SP-3b would not comply with State of Oregon requirements because the mine waste repository would still be within the Augur Creek floodplain.

In order to meet the State requirements Alternative SP-3b was modified as discussed in Section 9.3.1.3. This change requires movement of approximately 138,000 cubic yards of the protore stockpile from the Augur Creek floodplain. While this is a larger volume of material than was originally described in the FS for this alternative, this action serves the same purpose, to prevent erosion, and therefore could have been reasonably anticipated based on the information in the Proposed Plan.

The preferred alternative also identified a 12-inch rock bio-barrier covered by a 12-inch soil cover for the White King mine waste repository. After the public comment period, EPA sought additional input on the cover design from the U.S. Army Corps of Engineers (COE) and other technical experts within EPA. The COE and others commented that the 12-inch soil layer, underlain by a 6 or 12-inch bio-barrier (cobbles) may not perform as intended and may effectively prevent plant root penetration and the establishment of vegetation on the soil cover. The 12-inch rock layer would also cause the cover soil to dry out very quickly (from above and below) leaving inadequate moisture for good vegetation. A poor stand of vegetation could lead to a higher long-term erosion rates of the 12-inch soil cover. In addition it was felt that 12 inches of soil alone is too thin to provide protection against large rainfall events and that 24 inches of soil would provide additional protection from long-term erosion. Based upon this input, EPA changed the soil cover design from 24 inches of rock/soil to 24 inches of soil. While this design does not eliminate potential biointrusion of the burrowing animal species present at the Mines site (mice and shrews), it will allow for establishment of vegetation and protection from erosion. EPA felt that establishment of vegetation outweighed the potential impact from burrowing animals, which can be easily addressed through annual maintenance. In addition field observations of the piles indicate no presence of burrowing animals and suggest the overburden material is not physically suited for constructing burrows. This change also could have been reasonably anticipated based on the information in the Proposed Plan.

Cost Calculations

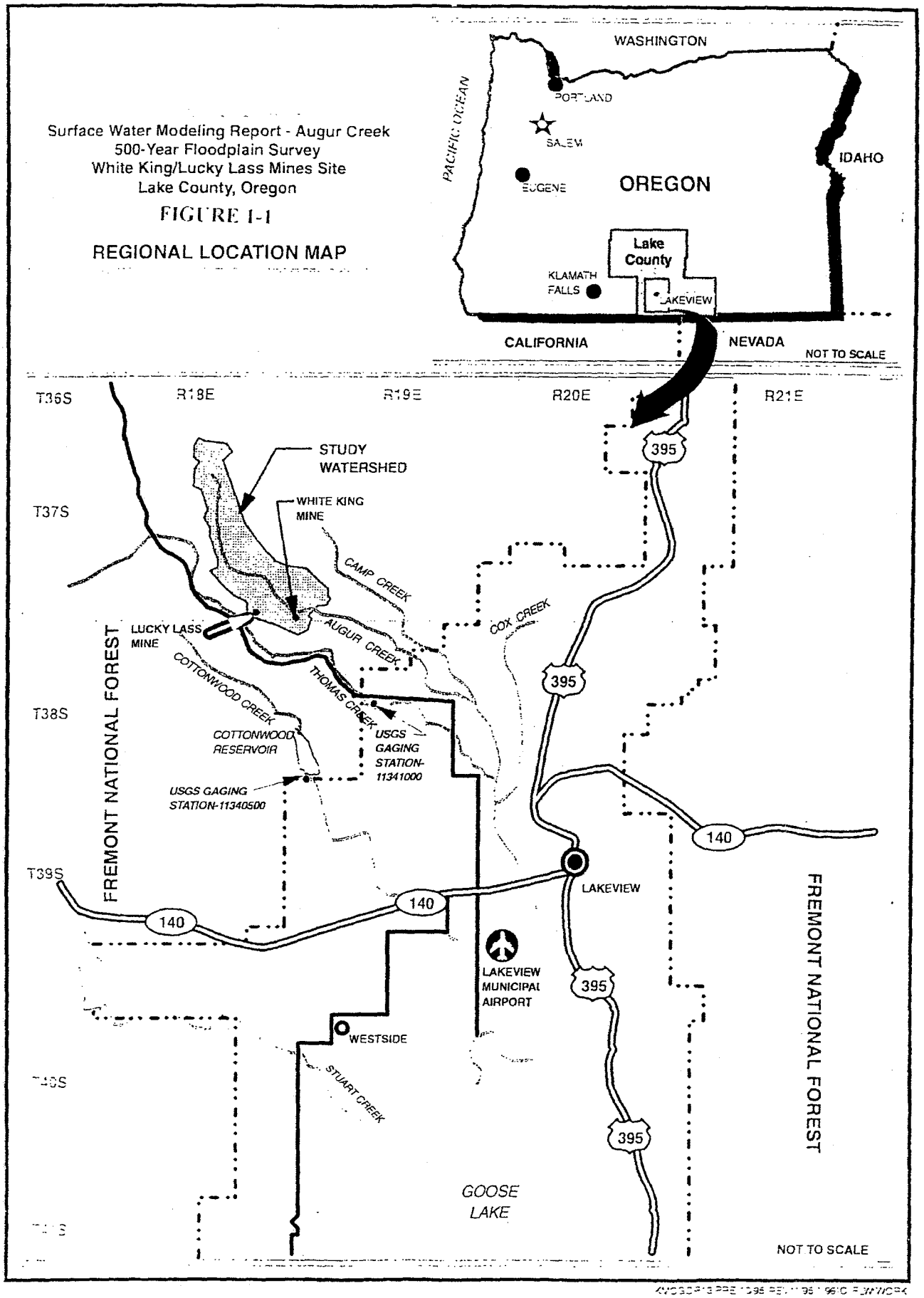
The cost estimates presented in the FS and the Proposed Plan included a 25% allowance for contingencies. After the public comment period EPA re-evaluated the FS cost estimates. Typically

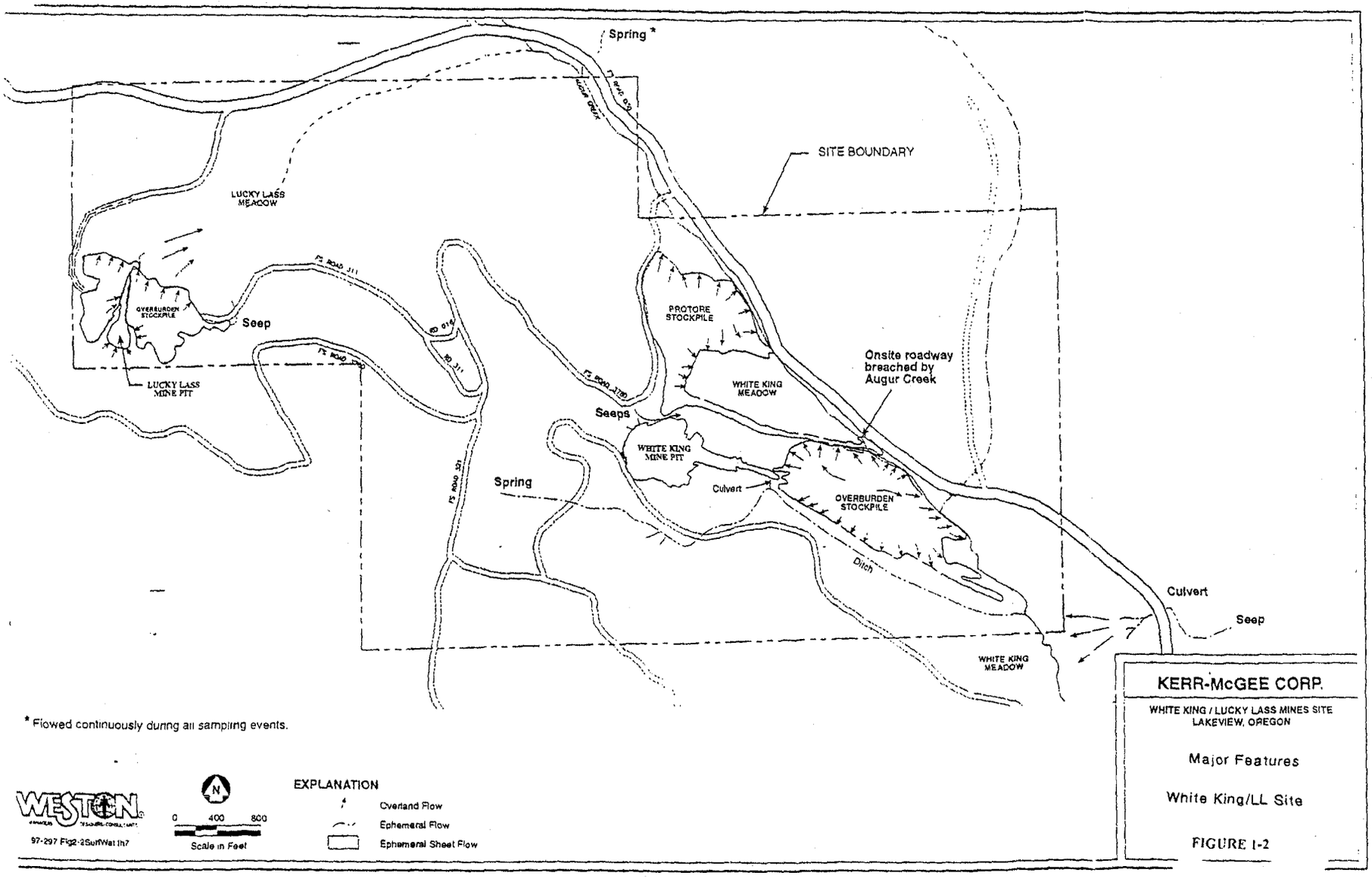
the contingency percentage is included to cover costs for unforseen construction conditions as well as costs for incomplete designs during construction. While it is possible for total percentage contingencies to reach 35% on some projects, this usually happens at projects with complex treatment trains utilizing a number of treatment technologies. At the Mines site EPA believes that there are few unknowns that would complicate the implementation of the stockpile remedy. The material to be excavated is easily identified and the volumes are known. There are no complex treatment processes or specific difficulty in handling the material. Therefore, EPA believes that it is more appropriate to use a 10% figure for contingency to estimate the costs of the stockpile alternative SP-3b which is reflected in **Table 11-1.** While it was also felt that the construction management costs were higher than what is typically used, these values were not changed. There have been no changes made in the costs associated with the selected alternative for the White King pond or Lucky Lass stockpile.

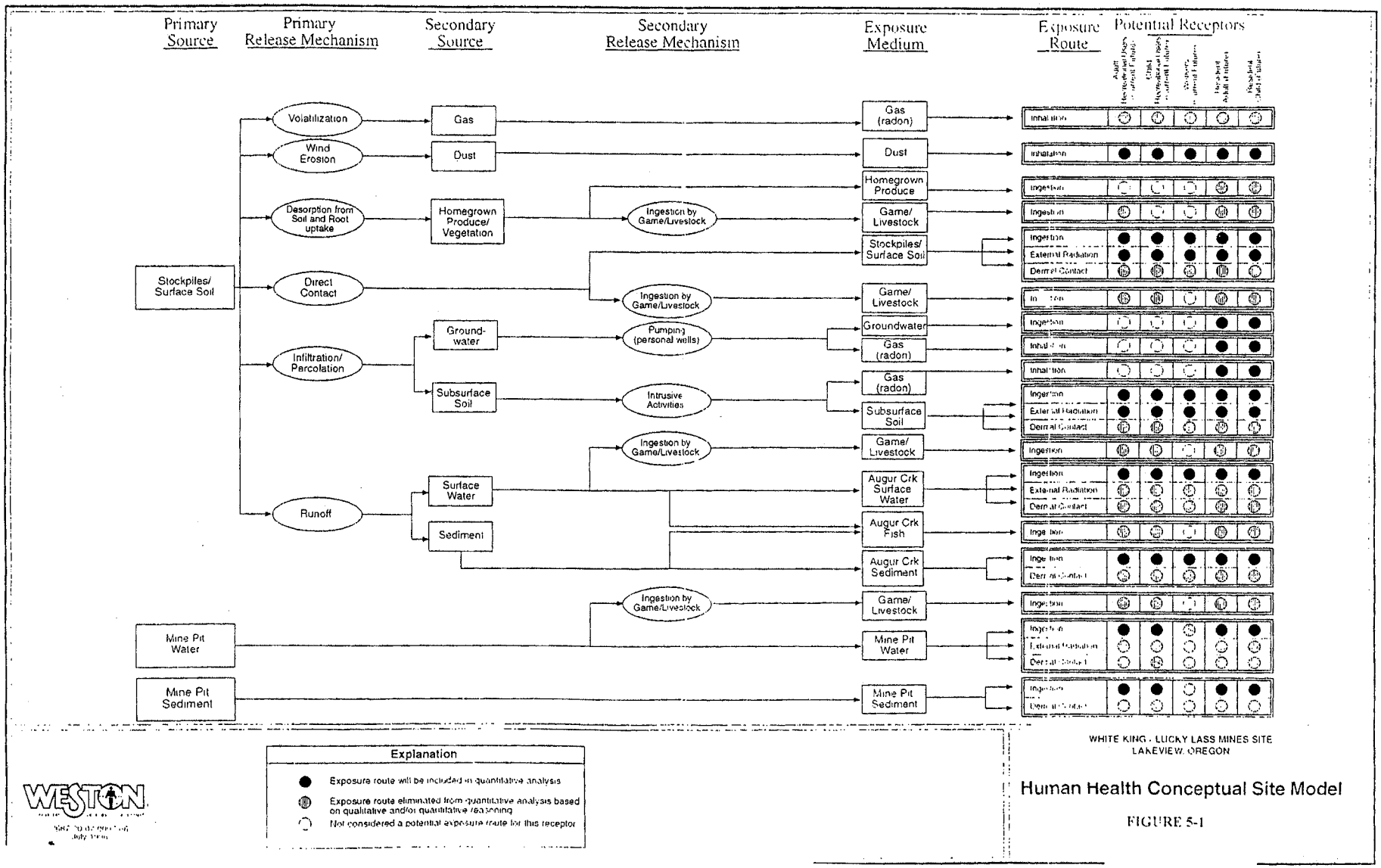
APPENDIX A

FIGURES FOR THE RECORD OF DECISION

WHITE KING/LUCKY LASS SITE


Surface Water Modeling Report - Augur Creek
500-Year Floodplain Survey
White King/Lucky Lass Mines Site
Lake County, Oregon
FIGURE 1-1
REGIONAL LOCATION MAP
WASHINGTON
PACIFIC OCEAN
PORTLAND
SALEM
EUGENE
OREGON
IDAHO
Lake County
KLAMATH FALLS
LAKEVIEW
CALIFORNIA
NEVADA
NOT TO SCALE
T36S
T37S
T38S
T39S
R18E
R19E
R20E
R21E
STUDY WATERSHED
WHITE KING MINE
LUCKY LASS MINE
CAMP CREEK
AUGUR CREEK
COX CREEK
COTTONWOOD CREEK
THOMAS CREEK
COTTONWOOD RESERVOIR
USGS GAGING STATION-11341000
USGS GAGING STATION-11340500
FREMONT NATIONAL FOREST
395
140
LAKEVIEW
LAKEVIEW MUNICIPAL AIRPORT
WESTSIDE
STUART CREEK
GOOSE LAKE
NOT TO SCALE


Spring *
SITE BOUNDARY
LUCKY LASS MEADOW
OVERBURDEN STOCKPILE
Seep
LUCKY LASS MINE PIT
PROTORE STOCKPILE
WHITE KING MEADOW
Onsite roadway breached by Augur Creek
Seeps
WHITE KING MINE PIT
Culvert
Spring
OVERBURDEN STOCKPILE
Ditch
Culvert
Seep
WHITE KING MEADOW
* Flowed continuously during all sampling events.
EXPLANATION
Overland Flow
Ephemeral Flow
Ephemeral Sheet Flow
0 400 800
Scale in Feet
97-297 Fig2-2SurfWat th7
KERR-McGEE CORP.
WHITE KING / LUCKY LASS MINES SITE
LAKEVIEW, OREGON
Major Features
White King/LL Site
FIGURE 1-2



WHITE KING - LUCKY LASS MINES SITE
LAKEVIEW, OREGON

Human Health Conceptual Site Model

FIGURE 5-1

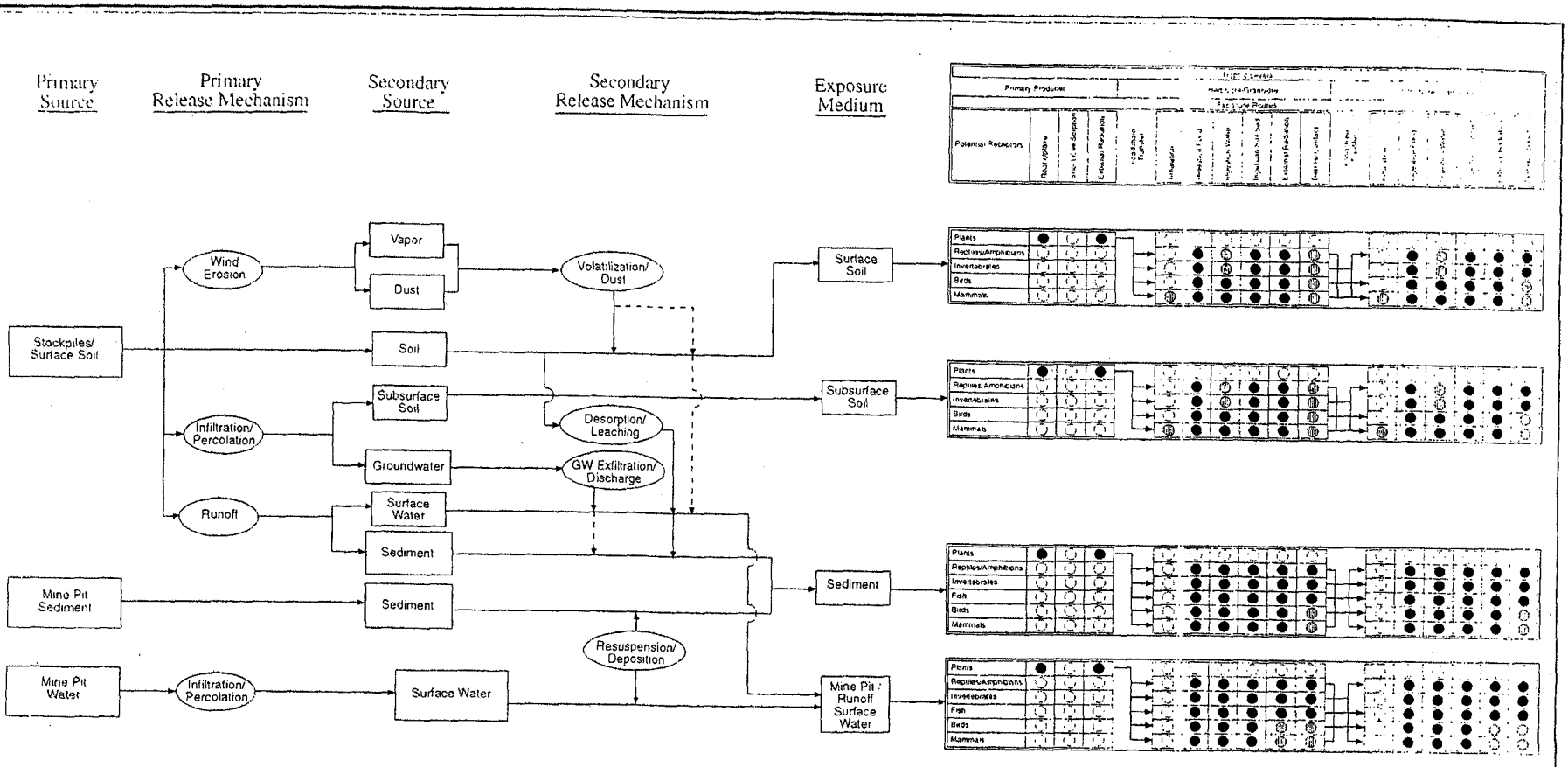
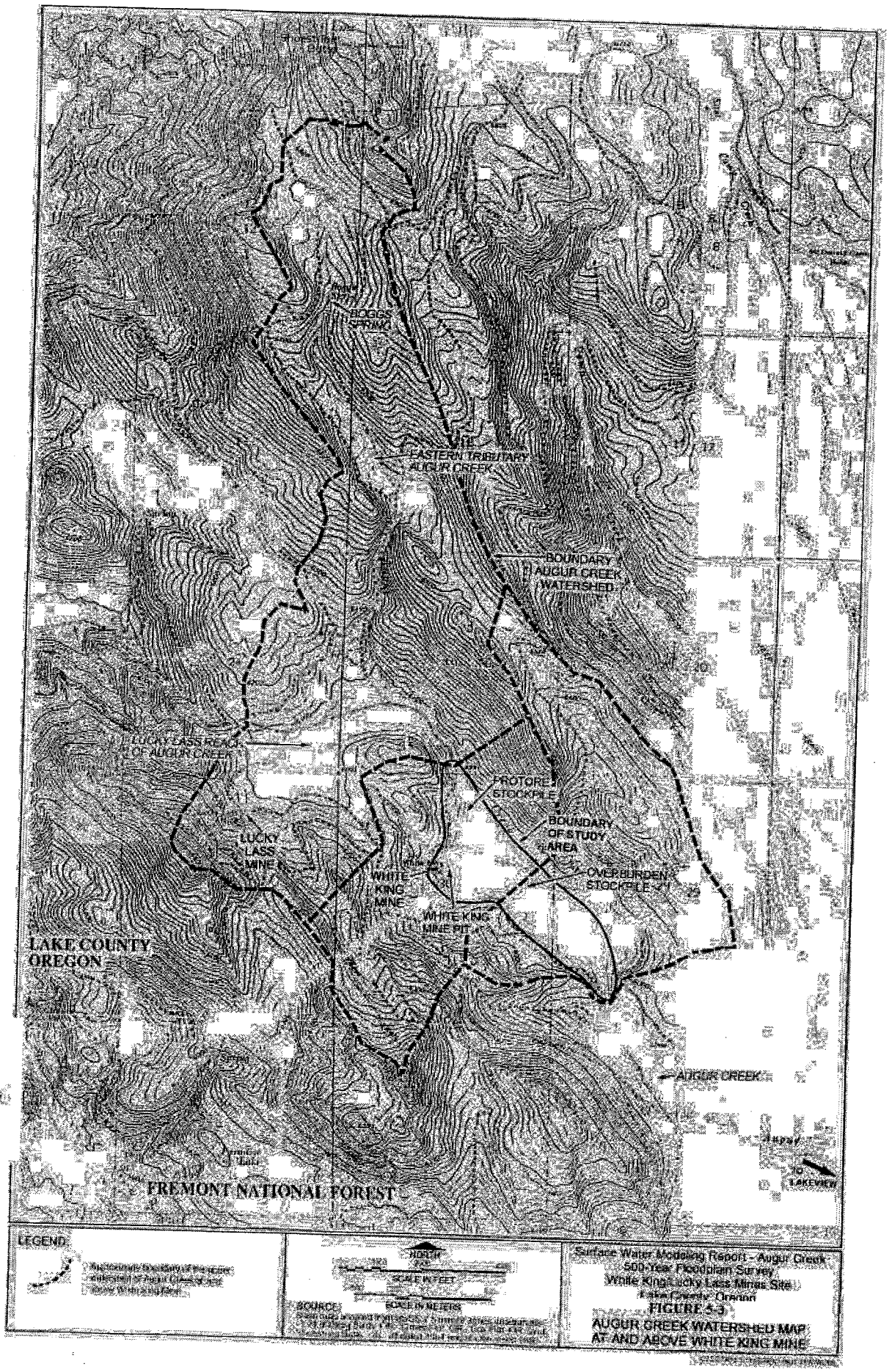
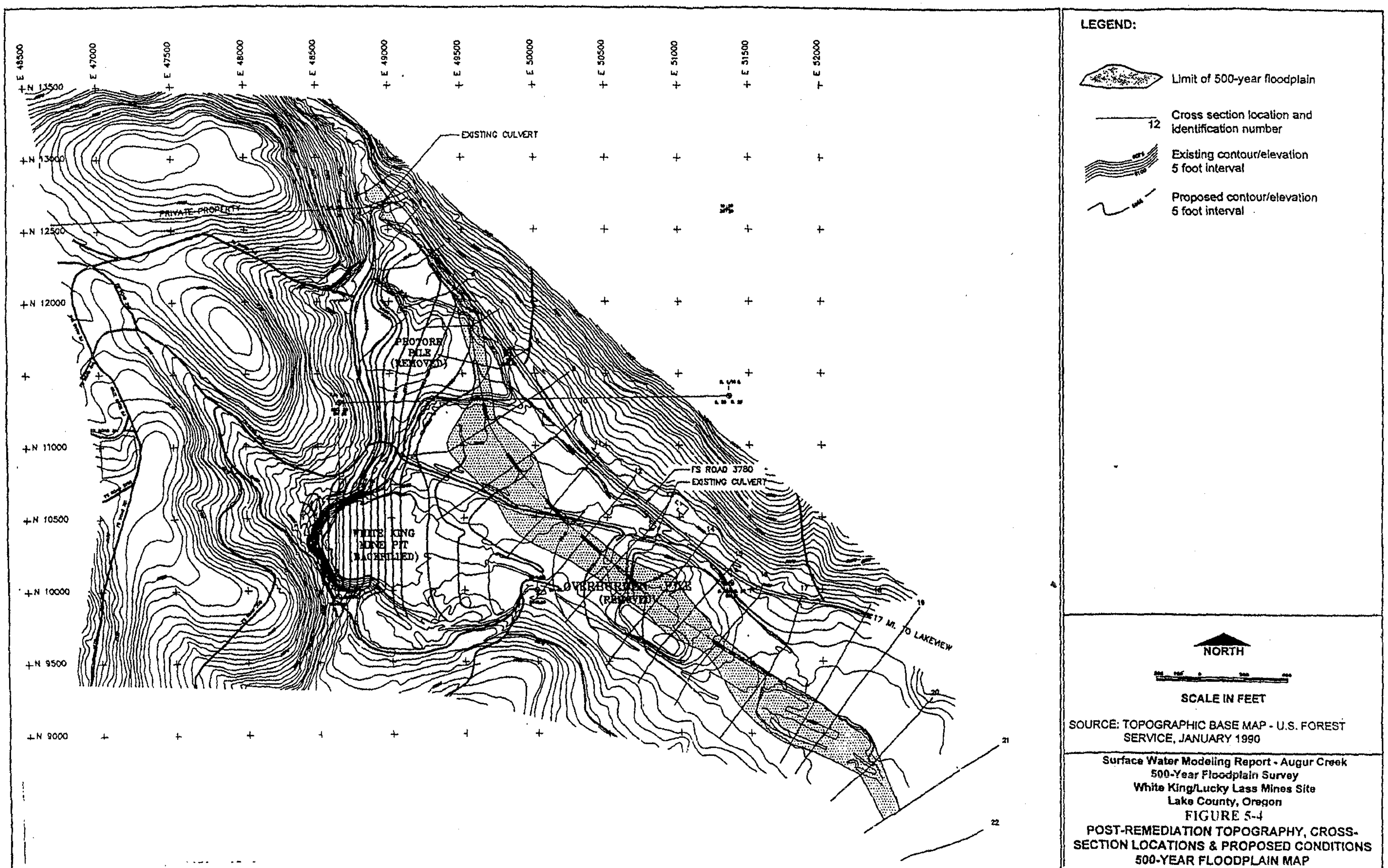

Primary Source
Primary Release Mechanism
Secondary Source
Secondary Release Mechanism
Exposure Medium
Stockpiles/ Surface Soil
Wind Erosion
Vapor
Dust
Soil
Infiltration/ Percolation
Subsurface Soil
Groundwater
Runoff
Surface Water
Sediment
Mine Pit Sediment
Sediment
Mine Pit Water
Infiltration/ Percolation
Surface Water
Volatilization/ Dust
Desorption/ Leaching
GW Exfiltration/ Discharge
Resuspension/ Deposition
Surface Soil
Subsurface Soil
Sediment
Mine Pit : Runoff Surface Water
Plants
Reptiles/Amphibians
Invertebrates
Fish
Birds
Mammals
Explanation
Primary exposure route
Potential exposure route
No exposure expected
Primary route of migration
Potential route of migration
Note
Crossover lines indicate that release mechanisms contribute to the exposure medium and/or food chain transfer occurs between the receptors
WESTON
WHITE KING / LUCKY LASS MINES SITE
LAKEVIEW, OREGON
Ecological Conceptual Site Model

FIGURE 5-2


HOGGS SPRING
EASTERN TRIBUTARY AUGUR CREEK
BOUNDARY OF AUGUR CREEK WATERSHED
LUCKY LASS REACH OF AUGUR CREEK
PROTORE STOCKPILE
BOUNDARY OF STUDY AREA
LUCKY LASS MINE
WHITE KING MINE
WHITE KING MINE PIT
OVERBURDEN STOCKPILE
LAKE COUNTY, OREGON
AUGUR CREEK
FREMONT NATIONAL FOREST
TO LAKEVIEW
LEGEND:
SCALE IN FEET
SCALE IN METERS
SOURCE:
Surface Water Modeling Report - Augur Creek 500-Year Floodplain Survey White King/Lucky Lass Mines Site Lake County, Oregon
FIGURE 5-3
AUGUR CREEK WATERSHED MAP AT AND ABOVE WHITE KING MINE



SOURCE: TOPOGRAPHIC BASE MAP - U.S. FOREST SERVICE, JANUARY 1990

Surface Water Modeling Report - Augur Creek
500-Year Floodplain Survey
White King/Lucky Lass Mines Site
Lake County, Oregon

FIGURE 5-4

POST-REMEDIATION TOPOGRAPHY, CROSS-SECTION LOCATIONS & PROPOSED CONDITIONS 500-YEAR FLOODPLAIN MAP

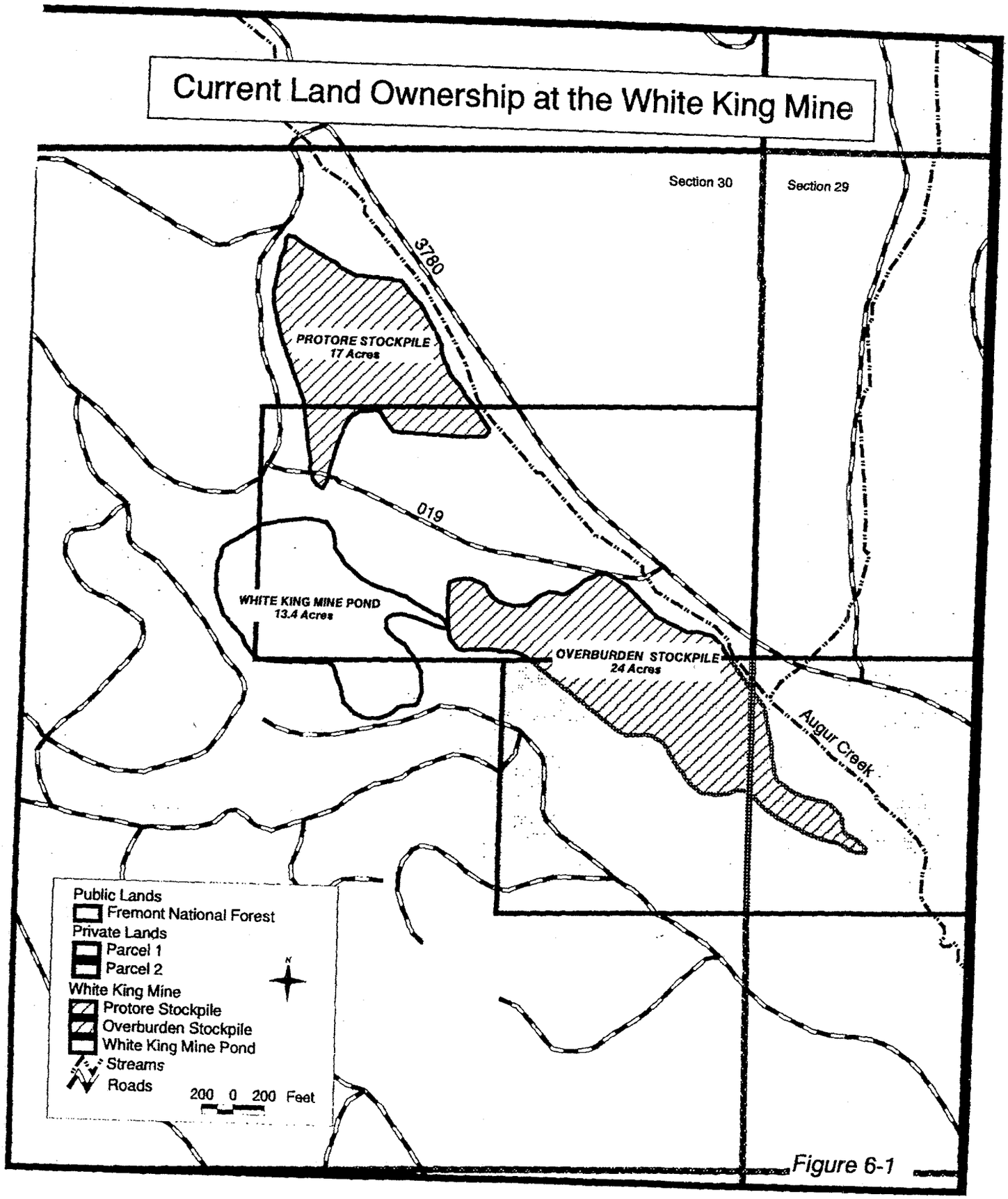
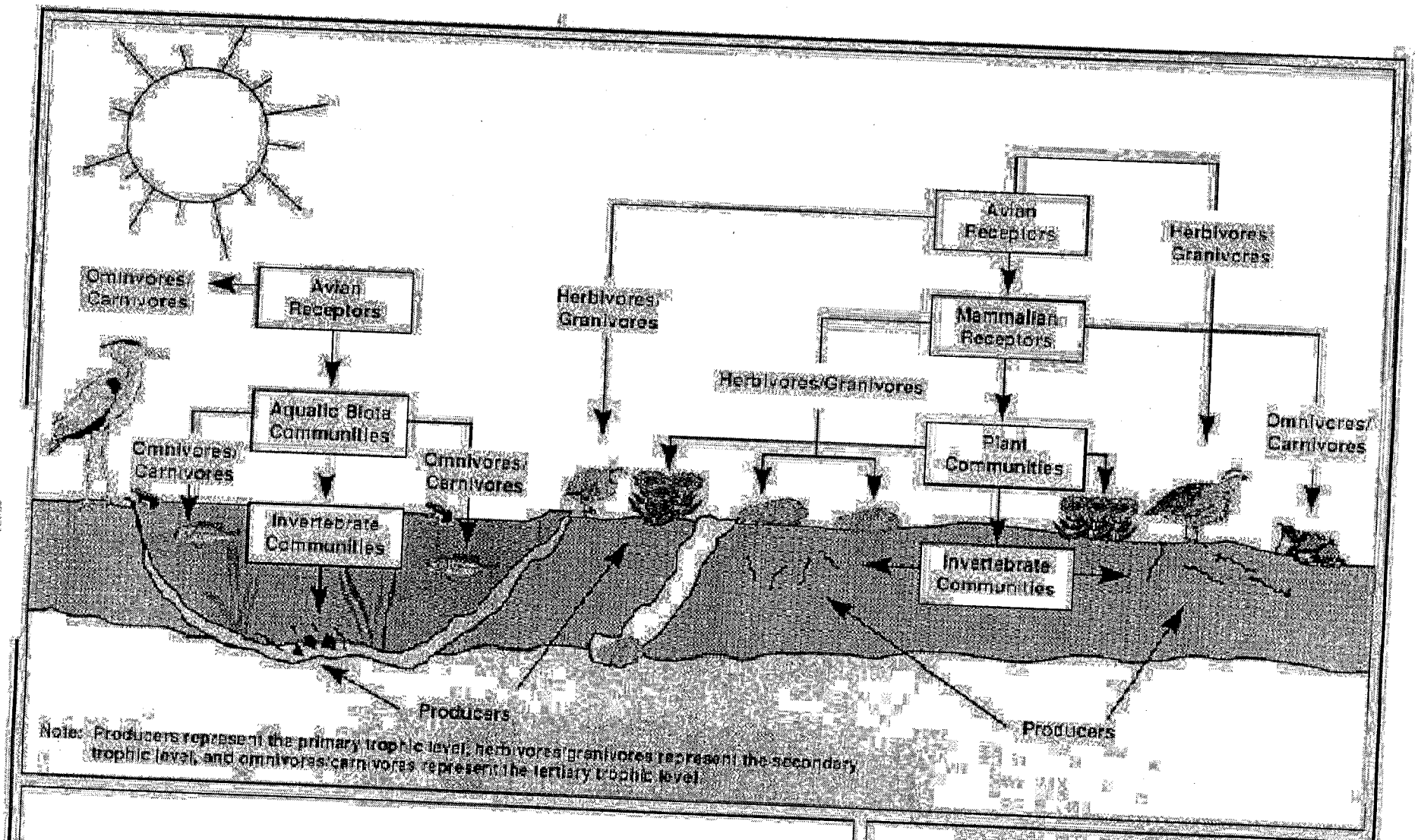

Current Land Ownership at the White King Mine
Section 30
Section 29
3780
PROTORE STOCKPILE
17 Acres
019
WHITE KING MINE POND
13.4 Acres
OVERBURDEN STOCKPILE
24 Acres
Augur Creek
Public Lands
Fremont National Forest
Private Lands
Parcel 1
Parcel 2
White King Mine
Protore Stockpile
Overburden Stockpile
White King Mine Pond
Streams
Roads
200 0 200 Feet
N

Figure 6-1



WESTON

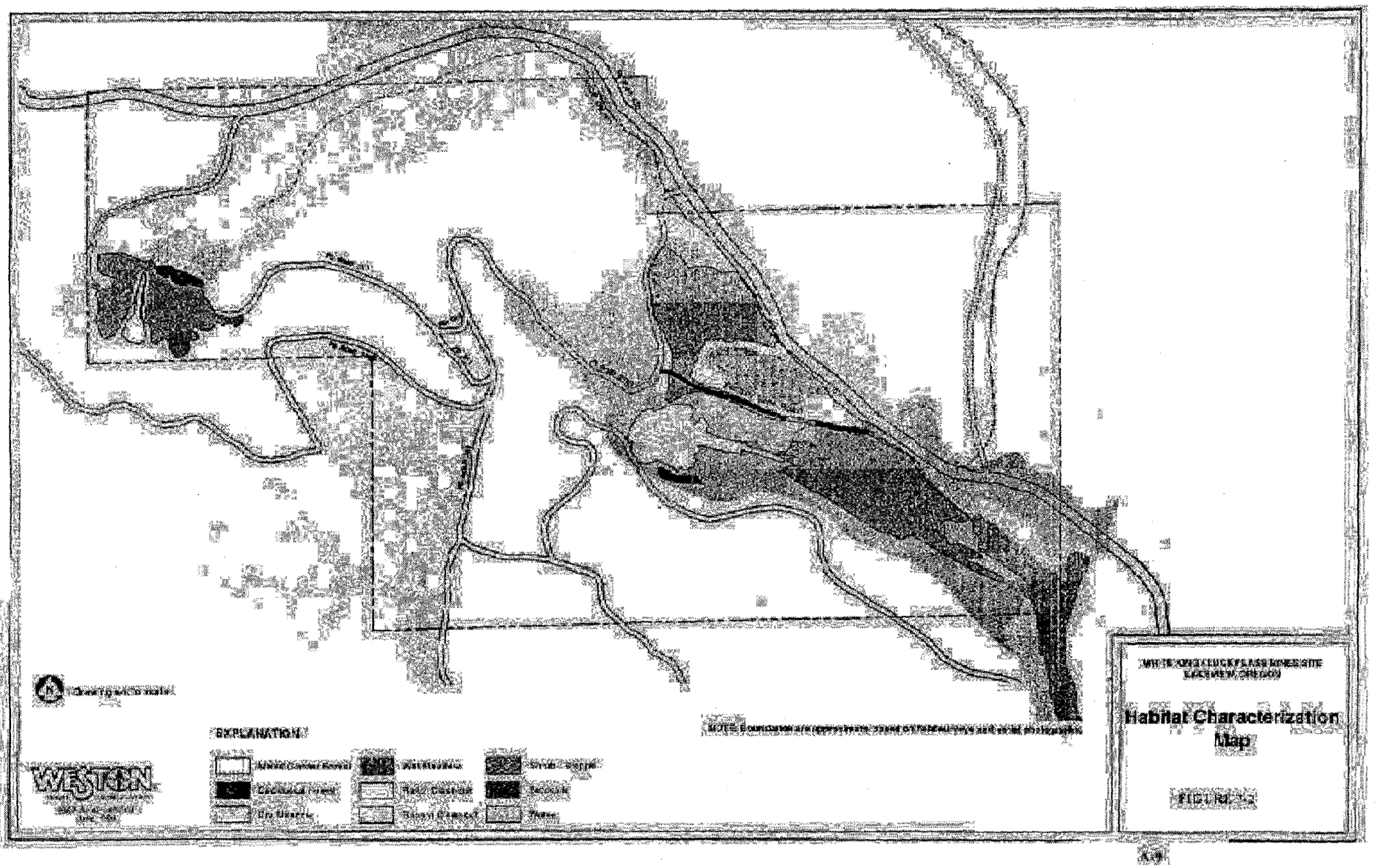
97-297 Fig 7-1.dgn

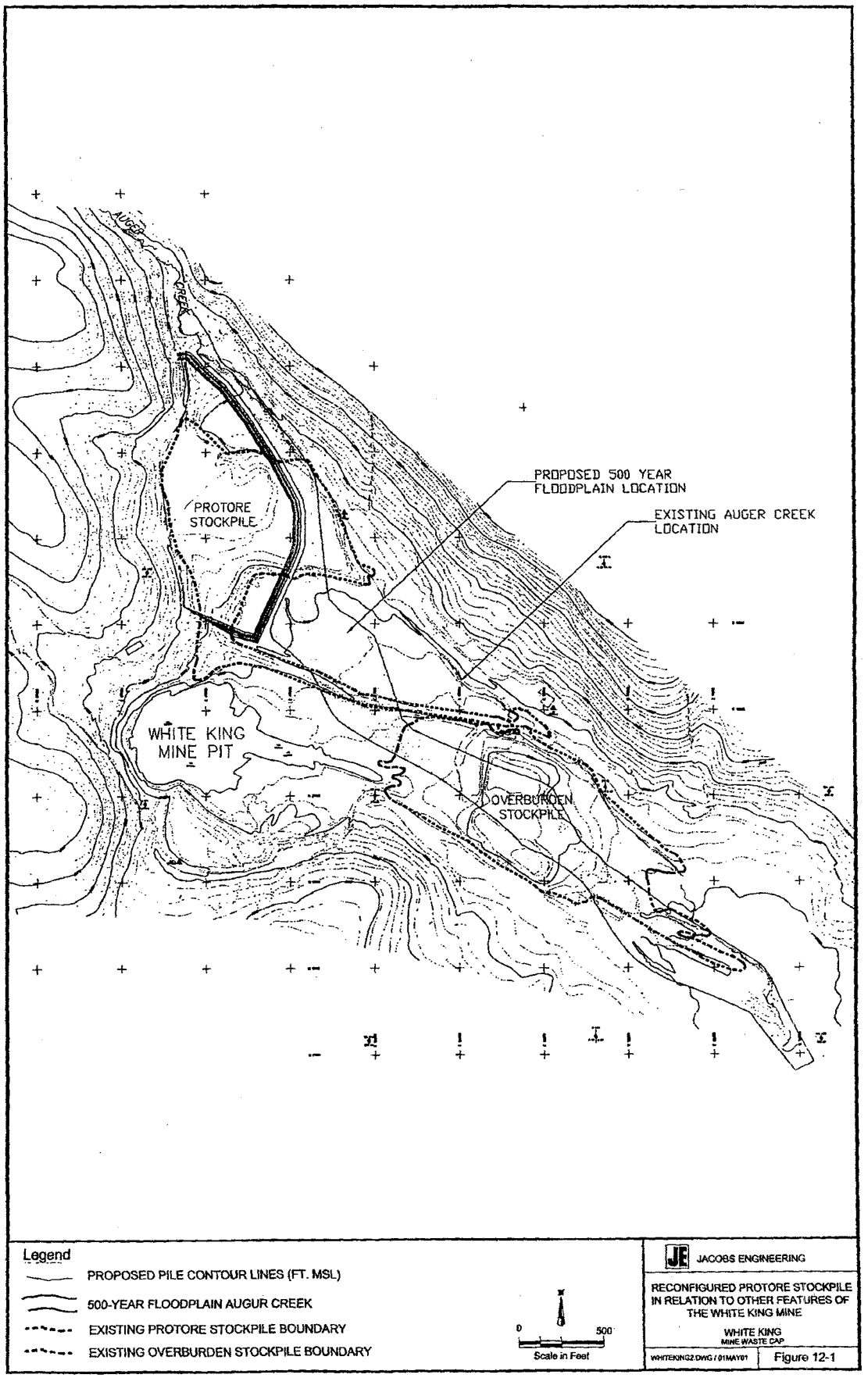
KERR-McGEE CORP.

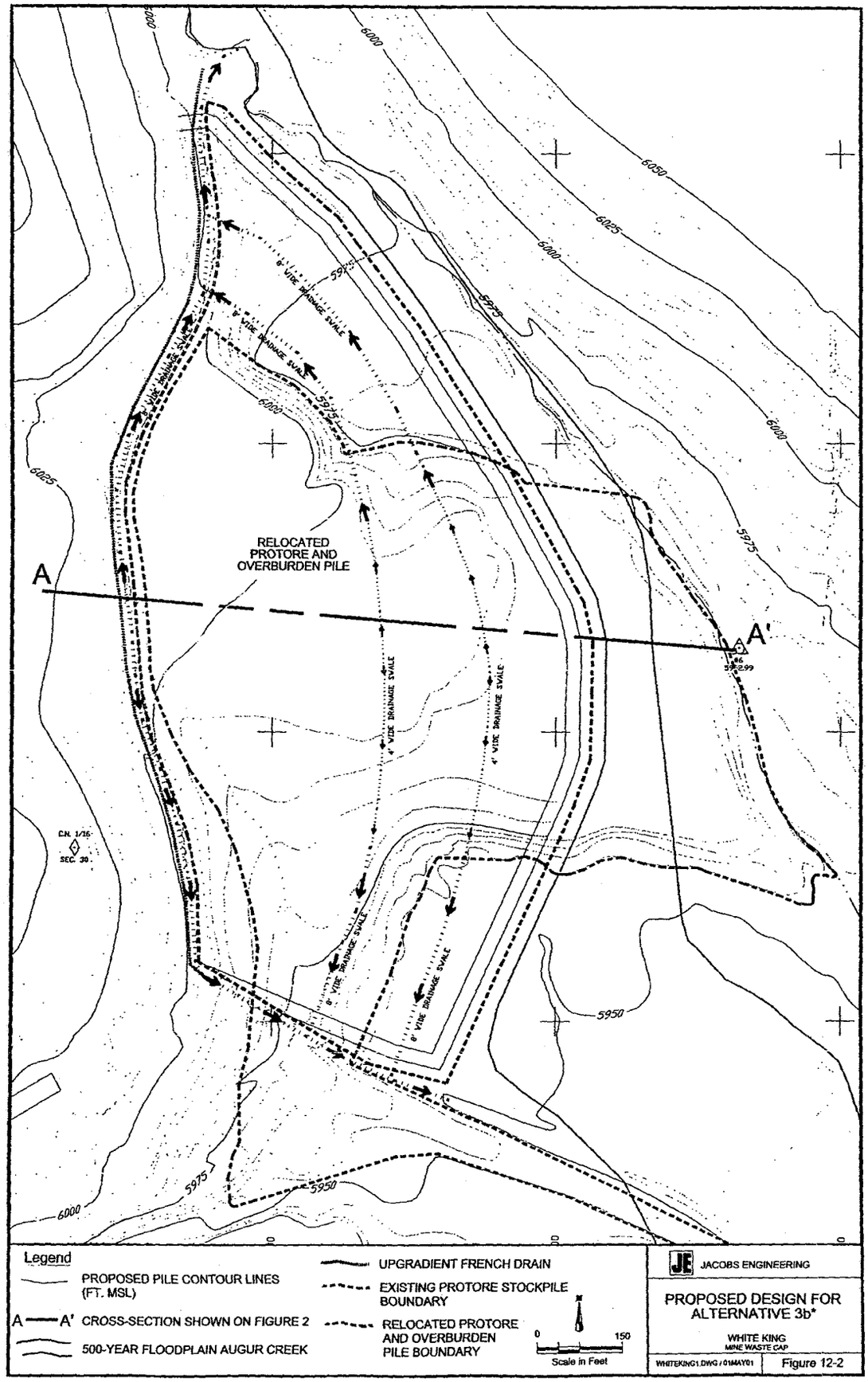
WHITE KING / LUCKY LASS MINES SITE
LAKEVIEW, OREGON

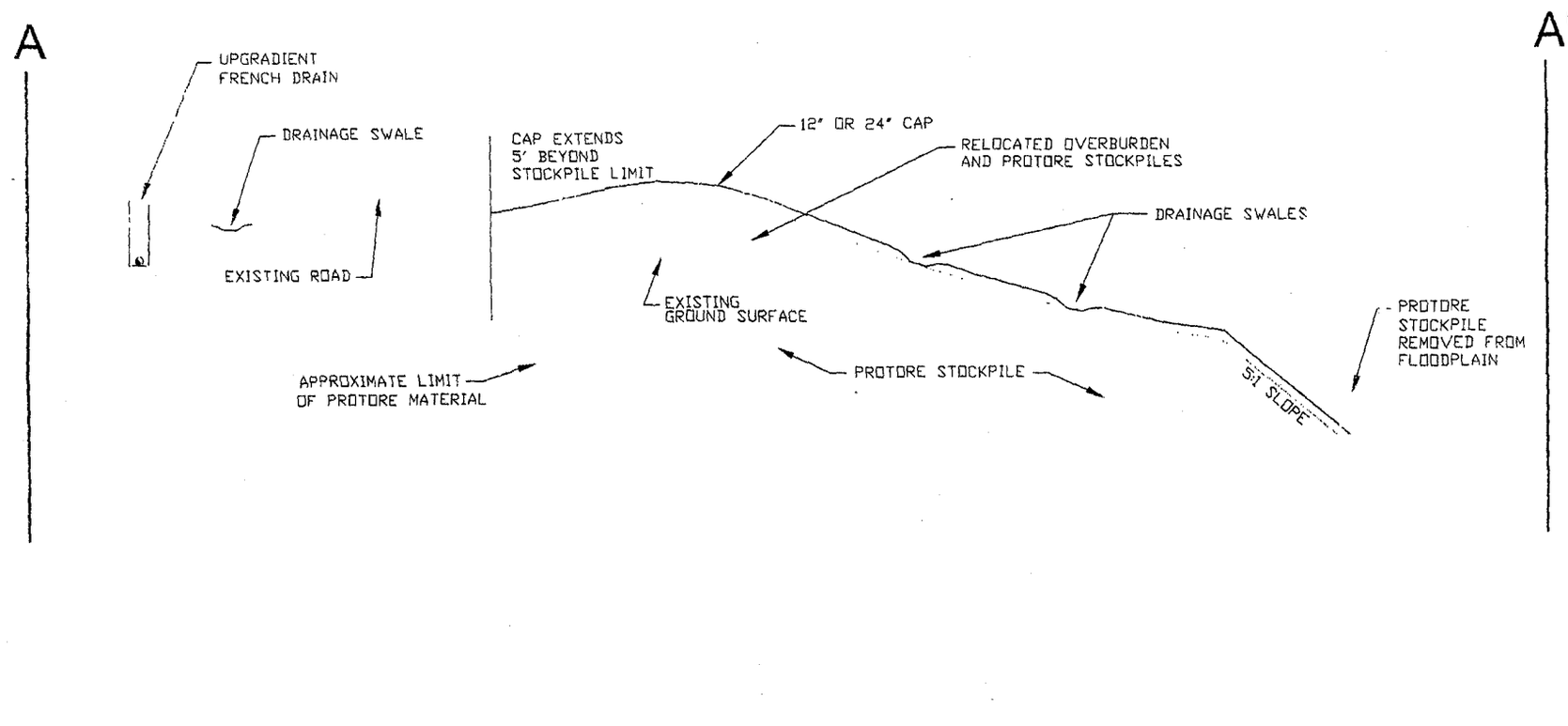
Receptor and Community Feeding Relationships Model

FIGURE 7-1


EXPLANATION
Habitat Characterization Map


AUGER
CREEK
PROTORE
STOCKPILE
PROPOSED 500 YEAR
FLOODPLAIN LOCATION
EXISTING AUGER CREEK
LOCATION
WHITE KING
MINE PIT
OVERBURDEN
STOCKPILE
Legend
PROPOSED PILE CONTOUR LINES (FT. MSL)
500-YEAR FLOODPLAIN AUGUR CREEK
EXISTING PROTORE STOCKPILE BOUNDARY
EXISTING OVERBURDEN STOCKPILE BOUNDARY
0
500
Scale in Feet
JACOBS ENGINEERING
RECONFIGURED PROTORE STOCKPILE
IN RELATION TO OTHER FEATURES OF
THE WHITE KING MINE
WHITE KING
MINE WASTE CAP
WHITEKING2.DWG / 01MAY01
Figure 12-1


RELOCATED PROTORE AND OVERBURDEN PILE
A
A'
6000
6025
6050
5975
5950
6" WIDE DRAINAGE SWALE
C.N. 1/16
SEC. 30
Legend
PROPOSED PILE CONTOUR LINES (FT. MSL)
A — A' CROSS-SECTION SHOWN ON FIGURE 2
500-YEAR FLOODPLAIN AUGUR CREEK
UPGRADIENT FRENCH DRAIN
EXISTING PROTORE STOCKPILE BOUNDARY
RELOCATED PROTORE AND OVERBURDEN PILE BOUNDARY
0
150
Scale in Feet
JACOBS ENGINEERING
PROPOSED DESIGN FOR ALTERNATIVE 3b*
WHITE KING MINE WASTE CAP
WHITEKING1.DWG / 01MAY01
Figure 12-2



CONSTRUCTION DETAILS OF FRENCH DRAIN AND DRAINAGE SWALES ON FIGURE 3

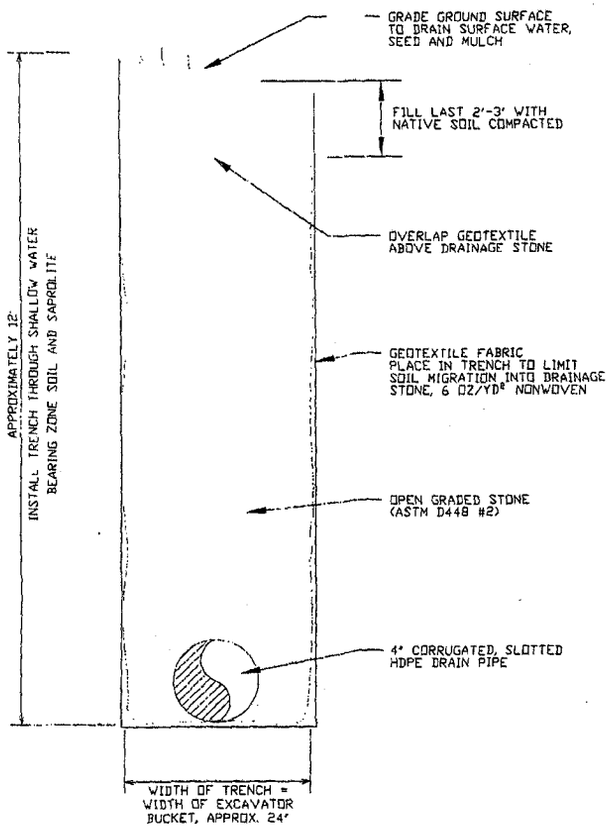
NOT TO SCALE

JACOBS ENGINEERING

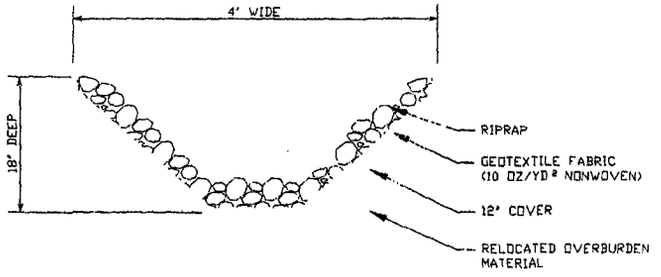
CROSS-SECTION A - A'
CAPPED CONSOLIDATED PROTORE AND OVERBURDEN STOCKPILE
ALTERNATIVE 3b*
WHITE WING
MINE WASTE CAP

CROSSECTION DWG / 12AUG00 SB

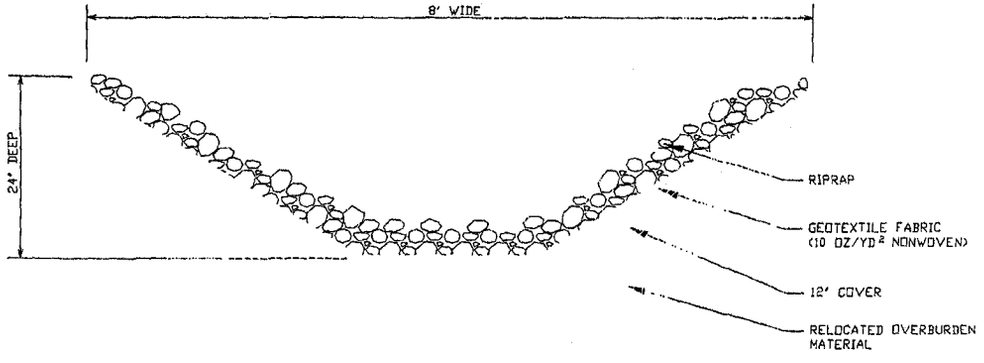
FIGURE 12-3



UPGRADIENT FRENCH DRAIN TO INTERCEPT SHALLOW GROUNDWATER



4' WIDE DRAINAGE SWALE



8' WIDE DRAINAGE SWALE

JACOBS ENGINEERING

PROPOSED DESIGN FOR ALTERNATIVE 3b* DETAILS

WHITE WING MINE WASTE CAP

SECTIONS.DWG / 13AUG0956

FIGURE 12-4

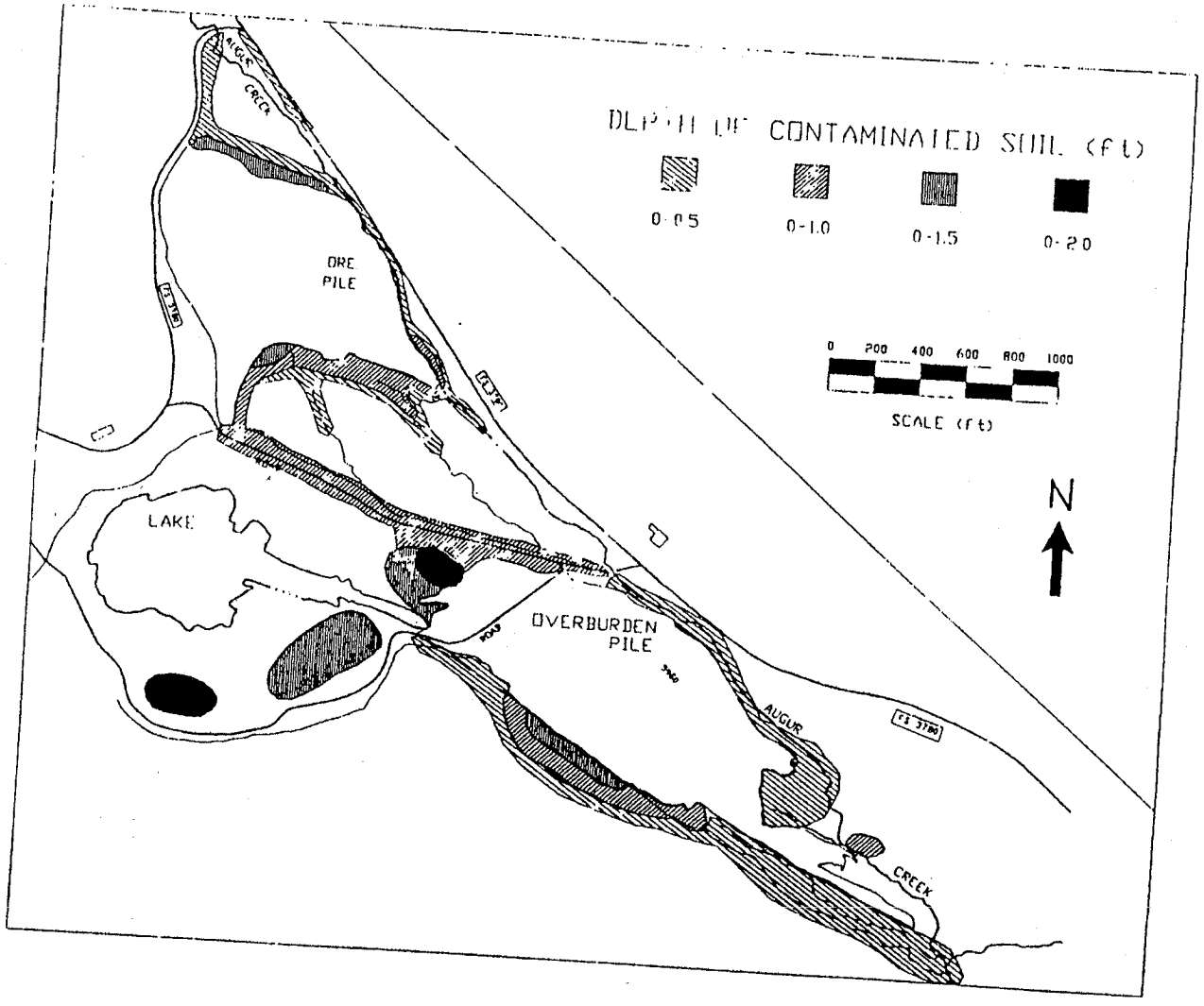


Figure C-5. Approximate Areas and Depths of Contaminated Soil at the White King Mine (from Robinet et al., 1990)

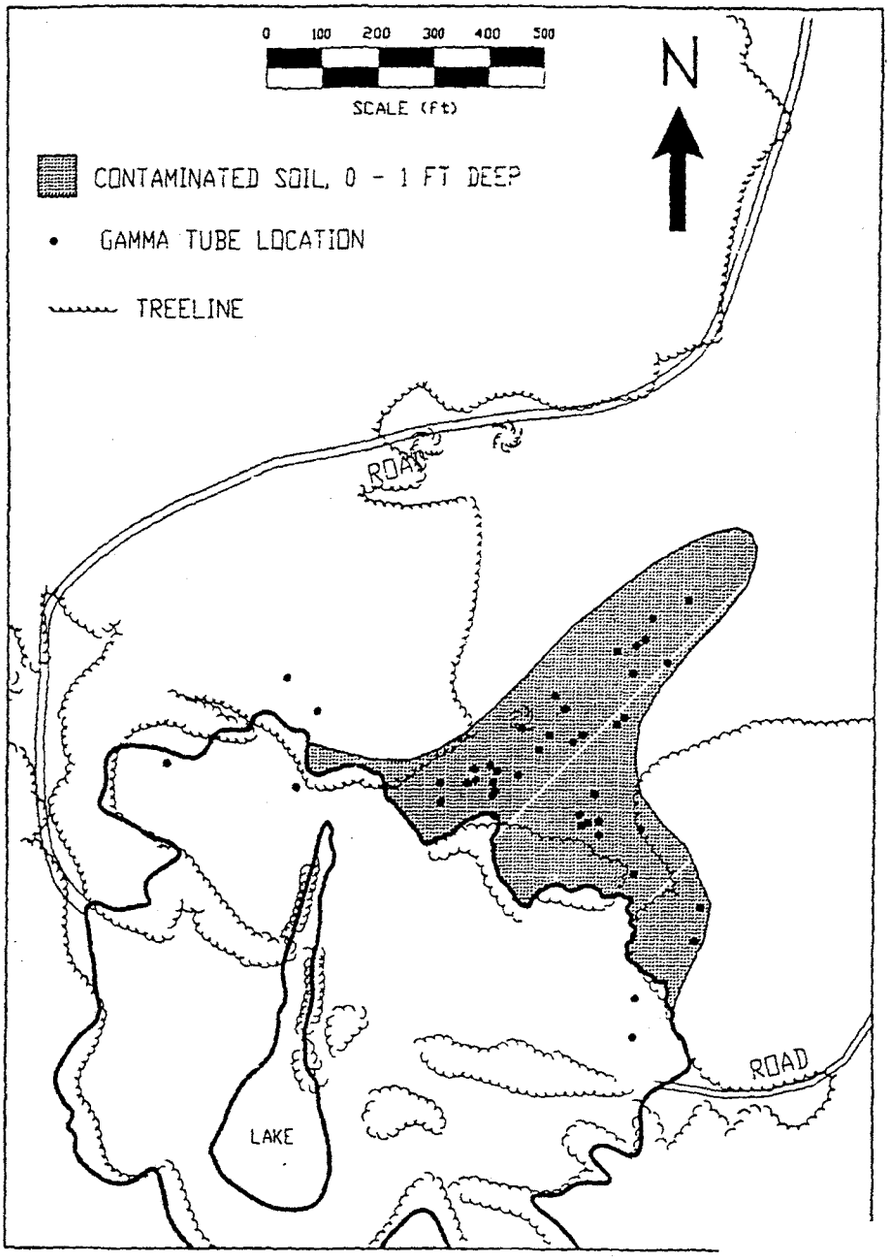


Figure 12-6 Areas of Contaminated Soil at the Lucky Lass Mine (from Robinet et al., 1990)

APPENDIX B

TABLES FOR THE RECORD OF DECISION

WHITE KING/LUCKY LASS SITE

TABLE 5-1 -White King Surface and Subsurface Soil—Comparisons to Standards

	Surface and Subsurface Soil			UMTRA	90% UCL		Selected for	90% UCL		Selected for
	Background		5Xs Background[a]	Soil Standards	Pile Concentration		Detailed Discussion[d]	Off-Pile Concentration		Detailed Discussion[d]
Inorganics (mg/kg)										
Aluminum	106000		530000	NV	23365		N	43783		N
Antimony	9.9	UJ	49.5	NV	76.4		Y	5.47		N
Arsenic	5.2		26	NV	2315		Y	111		Y
Barium	598		2990	NV	160		N	277		N
Beryllium	2		10	NV	4.27		N	2.49		N
Cadmium	0.67		3.35	NV	0.45		N	0.36		N
Chromium	57.2		286	NV	15.2		N	28.2		N
Cobalt	37.7		189	NV	9.27		N	17.45		N
Copper	61.2		306	NV	31		N	43.3		N
Iron	64800		324000	NV	17834		N	30348		N
Lead	13.6		68	NV	64.4		N	12.8		N
Manganese	1640		8200	NV	408		N	1478		N
Mercury	0.06	U	0.3	NV	11.3		Y	0.48		Y
Molybdenum*	NA		——	NV	535		N	8.07		N
Nickel	68.7		344	NV	16.6		N	31.3		N
Selenium	0.63	UJ	3.15	NV	2.04		N	3.6		N
Silver	0.95		4.75	NV	0.57		N	1.12		N
Strontium*	NA		——	NV	74.9		N	52.1		N
Thallium	0.47		2.35	NV	3.87		Y	1.26		N
Vanadium	159		795	NV	35.4		N	77.3		N
Zinc	88.8		444	NV	54.2		N	62		N
Radionuclides (pCi/g)										
Uranium 234	0.7		3.5	NV	24.3		Y	12.5		Y
Uranium 238	0.73		3.65	NV	23.2		Y	13.1		Y
Radium 226	0.31		1.55	5.36[b]/15.31[c]	35.8		Y	1.2		N
Radium 228	0.53		2.65	NV	0.92		N	0.54		N
Thorium 228*	NA		——	NV	——		N	——		N
Thorium 230	1.15		5.75	NV	37.4		Y	2.63		N
Thorium 232	0.75		3.75	NV	0.99		N	0.49		N

a - When the background concentration was undetected 5 times the detection limit was used

b - UMTRA surface soil standard is the background value plus 5 pCi/g

c - UMTRA subsurface soil standard is the background value plus 15 pCi/g

d - The compounds selected for detailed discussion had 90% UCL concentrations greater than the standard (or greater than 5 times background if no standard exists)

NA - Not analyzed

NV - No value

* Pre-RI data did not have background samples collected

U - Undetected

J - Estimated

TABLE 5-2 -Lucky Lass Surface and Subsurface Soil—Comparisons to Standards

	Surface and Subsurface Soil			UMTRA	90% UCL		Selected for	90% UCL		Selected for
	Background		5Xs above Background[a]	Soil Standards	Pile Concentration		Detailed Discussion	Off-Pile Concentration		Detailed Discussion
Inorganics (mg/kg)										
Aluminum	85185		425925	NV	26745		N	31122		N
Antimony	9.7		48.5	NV	4.83		N	3.96		N
Arsenic	3.9		19.5	NV	5.75		N	3.3		N[e]
Barium	663		3315	NV	452		N	288		N
Beryllium	2.4		12	NV	2.04		N	1.51		N
Cadmium	0.55		2.75	NV	0.39		N	0.28		N
Chromium	25		125	NV	11.8		N	17		N
Cobalt	28		140	NV	11.9		N	10.8		N
Copper	53		265	NV	24.5		N	27.1		N
Iron	47200		236000	NV	22765		N	24262		N
Lead	16.7		83.5	NV	12.5		N	13.4		N
Manganese	3020		15100	NV	1626		N	770		N
Mercury	0.06	U	0.3	NV	0.03		N	0.03		N
Molybdenum*	NA		------	NV	-------		N	3.22		N
Nickel	36		180	NV	13.8		N	16.7		N
Selenium	1		5	NV	1.28		N	1.45		N
Silver	0.72		3.6	NV	1.01		N	1.58		N
Strontium*	NA		------	NV	------		N	119		N
Thallium	0.36		1.8	NV	0.38		N	0.35		N
Vanadium	128		640	NV	49.9		N	54.5		N
Zinc	107		535	NV	49.7		N	51		N
Radionuclides (pCi/g)										
Uranium 234	1.35		6.75	NV	3.67		N	2.11		N
Uranium 238	1.19		5.95	NV	3.69		N	2.19		N
Radium 226	0.72		3.6	5.36[b]/15.31[c]	2.49		N	1.47		e
Radium 228	0.79		3.95	NV	1.08		N	0.77		N
Thorium 228*	NA		------	NV	------		N	------		N
Thorium 230	1.14		5.7	NV	3.68		N	2.05		N
Thorium 232	1.08		5.4	NV	1.08		N	0.74		N

a - When the background concentration was undetected, 5 times the detection limit was used.

b - UMTRA surface soil standard is the background value plus 5 pCi/g.

c - UMTRA subsurface soil standard is the background value plus 15 pCi/g.

d - The compounds selected for detailed discussion had 90% UCL concentrations greater than the standard or greater than 5 times background if no standard existed.

e - Arsenic and Radium-226 were selected for detailed discussion even though they do not meet the criteria for selection. Their selection at Lucky Lass was based only on their significance at White Mesa.

NA - Not analyzed

NV - No value

* Pre-RI data did not have background samples collected

U - Undetected

Table 5-3 Stockpile Soil Comparisons

	White King Protore Pile				White King Overburden Pile				Lucky Lass Overburden Pile			
	Ave Conc. Surface Soil	Ave. Conc. 2.5-10ft	Ave. Conc 10ft-Nat	Ave. Conc. Native-10ft.	Ave Conc. Surface Soil	Ave. Conc. 2.5-10ft	Ave. Conc 10ft-Nat	Ave. Conc. Native-10ft	Ave Conc. Surface Soil	Ave. Conc. 2.5-10ft	Ave. Conc 10ft-Nat	Ave. Conc. Native-10ft
Antimony	32.9	39.61	103.38	12.5	ND	89.3	7.65	ND	ND	ND	ND	4.53
Arsenic	3945.25	2797.5	776.43	1086	769	3677.6	756.45	59.53	11.9	3.68	2.28	6.42
Mercury	NR	10.51	3.87	13.1	NR	20.77	2.34	0.98	ND	ND	ND	ND
U -234	NR	54.77	12.09	9.32	NR	22.88	12.22	2.98	NR	1.87	1.76	4.46
U-238	NR	54.08	12.25	8.11	NR	20.2	11.09	2.8	NR	2.02	1.81	4.18
Ra-226	NR	36.88	11.66	6.58	NR	53.14	28.37	1.64	NR	1.99	1.43	2.33
Ra-228	NR	0.89	0.87	0.52	NR	1.11	0.87	0.48	NR	1.11	1.07	0.84
Th-230	NR	61.77	10.28	6028	NR	51.85	22.06	2.74	NR	1.71	1.48	4.6
Th-232	NR	1.07	0.88	0.89	NR	1.27	0.8	0.4	NR	1.01	1.23	0.86

Inorganics - mg/kg
Radionuclides - pCi/g
ND- Non-detected
NR- No result

TABLE 5-4 –Augur Creek, Seep, and Drainage Channel Surface Water Comparison to Standards

Analytes	Background		5X Background[a]	AWQC[b] Freshwater Chronic	Oregon Standard	90% UCL		Selected for Detailed Discussion[c]
Total Inorganics (µg/L)								
Aluminum	1600		8000	N/A	-	654		N
Antimony	50	U	250	1600	1600	25.0	U	N
Arsenic	10.5		52.5	190[d]	190[d]	11.1		N
Barium	44.4		222	N/A	-	28.0		N
Beryllium	1	U	5	5.3[e]	5.3	0.5	U	N
Cadmium	2	U	10	1.1[f]	1.1	1.0	U	N
Chromium	5	U	25	11	11	2.5		N
Cobalt	3	U	15	N/A	-	1.5		N
Copper	7.6		38	12[f]	12	1.7		N
Iron	917		4585	1000	1000	626		N
Lead	2.1		10.5	3.2[f]	3.2	3.3		Y
Manganese	46.3		231.5	N/A		95		N
Mercury	0.1	U	0.5	0.012	0.012	0.06		Y
Nickel	11.7		58.5	160[f]	160	5.7		N
Selenium	1.8		9	35	35	1.0		N
Silver	3	U	15	0.12	0.12	1.5	U	N
Thallium	1	U	5	40[f]	40	0.55		N
Vanadium	4.7		23.5	N/A	-	2.6		N
Zinc	10		50	110[f]	110	6.7		N
Radionuclides (pCi/L)								
Uranium 234	0.5	U	2.5	N/A	-	2.67		Y
Uranium 238	0.5	U	2.5	N/A	-	2.82		Y
Radium 226	0.5	U	2.5	N/A	-	0.28		N
Radium 228	1	U	5	N/A	-	0.5	U	N
Thorium 230	0.98		4.9	N/A	-	0.36		N
Thorium 232	0.5	U	2.5	N/A	-	0.2	U	N

a - If background concentrations were undetected, 5x the detection limit was used.

b - EPA, 1986, Oregon Regulation 340.41; Ambient Water Quality Criteria.

c - Analyte was selected for detailed discussion if the 90% UCL concentration was > the standard or > 5x background if no standard exists.

d - Trivalent arsenic standard is used in lieu of total arsenic standard.

e - Insufficient data to develop criteria; value presented is the Lowest Observed Effects Level.

f - Hardness dependent criteria (100 mg/L used).

N/A: Not available.

U = Undetected

TABLE 5-5 -White King and Lucky Lass Ponds Surface Water—Comparison to Standards

Analytes	AWQC* Freshwater Chronic	White King Pond 90% UCL		Selected for Detailed Discussion[d]	Lucky Lass Pond 90% UCL		Selected for Detailed Discussion[d]
Total Inorganics (µg/L)							
Aluminum	N/A	4130		N	4379		N
Antimony	1600	25.0	U	N	25	U	N
Arsenic	190[a]	99.4		N	17.4		N
Barium	N/A	33.7		N	27.8		N
Beryllium	5.3[b]	5.2		N	1.0	U	N
Cadmium	1.1[c]	2.0	U	N	2.0	U	N
Chromium	11	4.9	U	N	4.9	U	N
Cobalt	N/A	44.9		N	2.9	U	N
Copper	12[c]	12.2		Y	4.0		N
Iron	1000	1677		Y	2911		Y
Lead	3.2[c]	0.9		N	1.8		N
Manganese	N/A	1170		N	111		N
Mercury	0.012	0.1		Y	0.1	U	N
Nickel	160[c]	101		N	9.8	U	N
Selenium	35	6.0		N	2.5		N
Silver	0.12	2.9	U	N	2.9	U	N
Thallium	40[c]	1.9		N	1.0	U	N
Vanadium	N/A	2.0	U	N	7.4		N
Zinc	110[c]	159		Y	8.1		N
Radionuclides (pCi/L)							
Uranium 234	N/A	8.35		N	0.43		N
Uranium 238	N/A	8.17		N	0.79		N
Radium 226	N/A	0.81		N	0.62		N
Radium 228	N/A	0.98	U	N	0.98	U	N
Thorium 230	N/A	0.26		N	0.39		N
Thorium 232	N/A	0.19	U	N	0.3	U	N

* EPA, 1986, Oregon Regulation 340.41; Ambient Water Quality Criteria

N/A: Not available.

a: Trivalent arsenic standard is used in lieu of total arsenic standard.

b: Insufficient data to develop criteria; value presented is the Lowest Observed Effects Level.

c: Hardness dependent criteria (100 mg/l used).

d: Analyte was selected for detailed discussion if the 90% UCL concentration was greater than the standard. No background concentrations exist for pond surface water.

Note: For analytes that were all undetected, the "90% UCL" is the 90% UCL of the reported detection limits.

U = Undetected

TABLE 5-6 -Augur Creek and Drainage Channel Sediment—Comparison to Standards

Analytes	Background		5X Background[a]	Ontario Sediment Quality Standards Lowest Effect Level	90% UCL		Selected for Detailed Discussion[b]
Inorganics (mg/kg)							
Aluminum	51100		255500	NV	38826.3		N
Antimony	7.5		37.5	NV	7.7		N
Arsenic	4.2		21	6	65.2		Y
Barium	316		1580	NV	275.7		N
Beryllium	1.7		8.5	NV	2.4		N
Cadmium	0.5		2.7	0.6	0.7		Y
Chromium	35.8		179	26	33.0		Y
Cobalt	25.9		129.5	NV	29.5		N
Copper	48.9		244.5	16	39.5		Y
Iron	50500		252500	20000	41343.8		Y
Lead	11.2		56	31	9.4		N
Manganese	1610		8050	460	2461.7		Y
Mercury	0.09	U	0.45	0.2	0.1		N
Nickel	44.8		224	16	39.9		Y
Selenium	1.3		6.5	NV	0.5		N
Silver	0.9		4.6	NV	0.7		N
Thallium	0.33	U	1.65	NV	0.5		N
Vanadium	139		695	NV	112.3		N
Zinc	83.1		415.5	120	111.9		N
Radionuclides (pCi/g)							
Uranium 234	0.94		4.7	NV	10.8		Y
Uranium 238	0.53		2.7	NV	11.6		Y
Radium 226	0.44		2.2	NV	0.8		N
Radium 228	0.42		2.1	NV	0.4		N
Thorium 230	0.58		2.9	NV	1.8		N
Thorium 232	0.5	U	2.5	NV	0.3		N

Background concentrations determined from samples collected upgradient from the Mines site in Augur Creek.

a - If background concentrations were undetected, 5x the detection limit was used.

b - Analyte was selected for detailed discussion if the 90% UCL concentration was > the lowest effect level standard or > 5x background if no lowest effect level standard exists

NV - No value.

U = Undetected

TABLE 5-7 White King and Lucky Lass Ponds Sediment - Comparison to Standards

Analytes	Ontario Sediment Quality Standards Lowest Effect Level	White King Pond 90% UCL		Selected for Detailed Discussion[a]	Lucky Lass Pond 90% UCL		Selected for Detailed Discussion[a]
Inorganics (mg/kg)							
Aluminum	NV	36408		N	44883		N
Antimony	NV	219		N	N/A		N
Arsenic	6	24582		Y	6.5		Y
Barium	NV	149		N	240		N
Beryllium	NV	6.8		N	1.5		N
Cadmium	0.6	0.3	U	N	0.3	U	N
Chromium	26	15.8		N	14.9		N
Cobalt	NV	12.4		N	12.3		N
Copper	16	31.8		Y	31.6		Y
Iron	20000	58956		Y	32289		Y
Lead	31	43.5		Y	9.5		N
Manganese	460	304		N	739		Y
Mercury	0.2	9.6		Y	0.1	U	N
Nickel	16	19.1		Y	17.9		Y
Selenium	NV	0.5		N	0.7	U	N
Silver	NV	0.8		N	0.7		N
Thallium	NV	6.0		N	0.9		N
Vanadium	NV	60.0		N	67.5		N
Zinc	120	82		N	77.6		N
Radionuclides (pCi/g)							
Uranium 234	NV	53.8		N	20.42		N
Uranium 238	NV	53.3		N	18.92		N
Radium 226	NV	53.3		Y[b]	17.78		Y[b]
Radium 228	NV	1.04		N	1.04		N
Thorium 230	NV	21.8		N	16.79		N
Thorium 232	NV	1.19		N	1.51		N

a - There are no background values for pond sediment. Analyte was selected for detailed discussion if the 90% UCL concentration was greater than the lowest effect standard.

b - Ra226 was selected for detailed discussion because it exceeds the UMTRA soil standards of 5.36 and 15.31 pCi/g for surface and subsurface soil, respectively

NV - No value.

N/A - All Lucky Lass pond antimony values were rejected during data validation.

Note: For analytes that were all undetected, the "90% UCL Detection" is the 90% UCL of the reported detection limits.

U = Undetected

TABLE 5-8 –Stockpile and Off-Pile Groundwater—Comparison to Standards

All Analytes	Background		5X Background[a]	Groundwater MCL	90% UCL Stockpile Concentration (µg/L)[b]		Selected for Detailed Discussion[c]	90% UCL Off-Pile Concentration (µg/L)		Selected for Detailed Discussion[c]
Total Inorganics (ug/L)										
Aluminum	3,280		16400	None	47,681		Y	28,173		Y
Antimony	50	U	250	6	68	U	N	31		Y
Arsenic	3.2		16	50	11,817		Y	22		N
Barium	39.8		199	1000	201		N	226		N
Beryllium	1	U	5	4	150		Y	4		N
Cadmium	2	U	10	10	13.8		Y	1.6		N
Chromium	5	U	25	50	26		N	25		N
Cobalt	3	U	15	None	222		Y	30		Y
Copper	2		10	1300	46		N	31		N
Iron	1,100		5500	None	41,350		Y	31,336		Y
Lead	3.6		18	50	10		N	6		N
Manganese	77.6		388	None	36,993		Y	1,022		Y
Mercury	0.1	U	0.5	2	1.0		N	1.5		N
Nickel	10	U	50	100	247		Y	110		Y
Selenium	5	U	25	10	4		N	3		N
Silver	3	U	15	50	14		N	2		N
Thallium	1	U	5	2	3.8		Y	1.7		N
Vanadium	4.6		23	None	25		Y	63		Y
Zinc	6		30	None	1,609		Y	145		Y
Sulfate (mg/L)	NA		NA	500[d]	1,757		Y	55		N
Radionuclides (pCi/L)										
Uranium 234	0.5	U	2.5	30[e]	5,110		Y	1		N
Uranium 238	0.5	U	2.5	30[e]	5,514		Y	1		N
Radium 226	0.5	U	2.5	5[e]	1.14		N	0.74		N
Radium 228	1	U	5	5[e]	0.87		N	1.26		N
Thorium 230	0.5	U	2.5	None	35		N[f]	0.42		N
Thorium 232	0.5	U	2.5	None	0.69		N	0.39		N
Radon	550		2750	300[d]	8,355		Y	508		N

[a] - When the background concentration was undetected, 5 times the detection limit was used.

[b] - Stockpile wells include: RFW-WK-MW-07-As/Ad - 10-As/Ad

[c] - The analytes selected for detailed discussion had 90% UCL concentrations greater than the standard (or greater than 5 times background if no standard exists).

[d] - Proposed MCL

[e] - 30 pCi/L is combined U 234 and U 238 UMTRA standard. 5 pCi/L is combined Ra 226 and Ra 228 UMTRA standard.

[f] - Thorium-230 will not be discussed in detail because there is no UMTRA groundwater protection standard for thorium-230 and thorium's solubility is greater than radium but less than uranium. Therefore, the uranium and radium discussions address thorium also.

U = Undetected

Table 7-1

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current Worker
Medium: Surface soil
Exposure Medium: Surface soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point[1] Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
White King Mine Soil	Arsenic	2.7	4,140	ppm	25/25	2637	ppm	95% UCL
	Radium-226	0.24	291	pCi/g	31/31	75.6	pCi/g	95% UCL

Key

ppm: Parts per million
pCi/g: Picocurie per gram
95% UCL: 95% Upper Confidence Limit
[1] Exposure point concentrations calculated using surface soil data, except for radionuclides, where a combination of surface and subsurface data were used

Table 7-2

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future Worker
Medium: Surface soil
Exposure Medium: Surface soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
White King Mine Soil	Arsenic	2.7	13,794	ppm	58/58	5,010	ppm	95% UCL
	Radium-226	.2	291	pCi/g	49/49	15.4	pCi/g	95% UCL

Key

ppm: Parts per million
pCi/g: Picocurie per gram
95% UCL: 95% Upper Confidence Limit

[1] Exposure point concentrations were calculated incorporating both surface soil and subsurface soil up to depth of 6 feet.

Table 7-3

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future Recreational User
Medium: Surface/subsurface soil
Exposure Medium: Surface/subsurface soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
White King Mine Soil	Arsenic	2.7	13,794	ppm	58/58	5010	ppm	95% UCL
	Radium-226	0.20	291	pCi/g	49/49	15.4	pCi/g	95% UCL

Key

pCi/g: Picocurie per gram
ppm: Parts per million
95% UCL: 95% Upper Confidence Limit

[1] Exposure point concentrations were calculated incorporating both surface soil and subsurface soil up to depth of 6 feet.

Table 7-4

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current Recreational User
Medium: Surface/subsurface soil
Exposure Medium: Surface/subsurface soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
White King Mine Soil	Arsenic	[illegible]	4,140	ppm	36/38	915.2	ppm	Log 95% UCL
	Radium-226	[illegible]	291	pCi/g	46/46	18.9	pCi/g	Log 95% UCL

Key

pCi/g: Picocurie per gram
ppm: Parts per million
95% UCL: 95% Upper Confidence Limit

[1] Exposure point concentrations calculated using surface soil data, except for radionuclides, where a combination of surface and subsurface data were used.

Table 7-5

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future Resident
Medium: Surface/subsurface soil
Exposure Medium: Surface/subsurface soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration[1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
WhiteKing Overburden Mine Soil	Arsenic	425	11,700	ppm	9/9	11,700	ppm	95% UCL
	Radium-226	3.3	291	pCi/g	7/7	291	pCi/g	95% UCL
Lucky Lass Off-Pile Mine Soil	Arsenic	0.85	15	ppm	16/17	5.6	ppm	95% UCL
	Radium-226	0.72	7.5	pCi/g	16/16	1.5	pCi/g	95% UCL
White King Shallow Groundwater[2]	Arsenic	2.7	21,900	ppm	17/19	21,900	ppm	95%UCL
Lucky Lass Deep Bedrock Groundwater[2]	Arsenic	31.4	39.4	ppm	2/2	39.4	ppm	95% UCL

Key

pCi/g: Picocurie per gram
ppm: Parts per million
95% UCL: 95% Upper Confidence Limit
[1] Exposure point concentrations were calculated incorporating both surface soil and subsurface soil up to a depth of 6 feet
2 Groundwater exposure point concentrations are the same for current and future receptors.

Table 7-6

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current/Future Recreational User
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration [1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Auger Creek Surface Water	Arsenic	4.4	41.8	ppb	11/17	41.8	ppb	MAX
White King Pond Surface Water	Arsenic	10.2	128.0	ppb	4/4	128.0	ppb	MAX

Key

ppb: Parts per billion
MAX: Maximum Concentration

[1] Exposure point concentrations calculated using surface soil data, except for radionuclides, where a combination of surface and subsurface data were used.

Table 7-7

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current/Future Recreational User
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration [1]	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Auger Creek Sediment	Arsenic	25.4	159	ppm	5/5	159	ppm	MAX

Key

ppm: Parts per million
MAX: Maximum Concentration
[1] Sediment exposure point concentration are the same for current and future receptors

TABLE 7-8 -Exposure Parameter Values—Reasonable Maximum Exposure
White King/Lucky Lass Mines Site
Lakeview, Oregon
(Continued)

Parameter	Receptor				
	Adult Recreational User (Current/Future)	Child Recreational User (Current/Future)	Worker (Current/Future)	Resident Adult (Future)	Resident Child (Future)
Inhalation of Particulates					
IH (m^3/day)	20	20	20	20	20
ED (yrs)	24	6	25	24	6
EF (days/yr)	26	26	23	183	183
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Ingestion of Augur Creek Surface Water					
IR_w (L/day)	0.5	0.5	0.5	0.5	0.5
EF (days/yr)	13	13	4	13	13
ED (yrs)	24	6	25	24	6
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Incidental Ingestion of Mine Pit Water					
IR_w (L/day)	0.1	0.1	NA	0.1	0.1
EF (days/yr)	12	12	NA	24	24
ED (yrs)	24	6	NA	24	6
BW (kg)	70	15	NA	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	NA	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Ingestion of Groundwater					
IR_w (L/day)	NA	NA	NA	2	1
EF (days/yr)	NA	NA	NA	350	350
ED (yrs)	NA	NA	NA	24	6
BW (kg)	NA	NA	NA	70	15
AT (days)	NA	NA	NA	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)

TABLE 7-8 -Exposure Parameter Values—Reasonable Maximum Exposure
White King/Lucky Lass Mines Site
Lakeview, Oregon
(Continued)

Parameter	Receptor				
	Adult Recreational User (Current/Future)	Child Recreational User (Current/Future)	Worker (Current/Future)	Resident Adult (Future)	Resident Child (Future)
Inhalation of Particulates					
IH (m^3/day)	20	20	20	20	20
ED (yrs)	24	6	25	24	6
EF (days/yr)	26	26	23	183	183
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Ingestion of Augur Creek Surface Water					
IR_w (L/day)	0.5	0.5	0.5	0.5	0.5
EF (days/yr)	13	13	4	13	13
ED (yrs)	24	6	25	24	6
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Incidental Ingestion of Mine Pit Water					
IR_w (L/day)	0.1	0.1	NA	0.1	0.1
EF (days/yr)	12	12	NA	24	24
ED (yrs)	24	6	NA	24	6
BW (kg)	70	15	NA	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	NA	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Ingestion of Groundwater					
IR_w (L/day)	NA	NA	NA	2	1
EF (days/yr)	NA	NA	NA	350	350
ED (yrs)	NA	NA	NA	24	6
BW (kg)	NA	NA	NA	70	15
AT (days)	NA	NA	NA	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)

TABLE 7-8 (cont) -Exposure Parameter Values—Reasonable Maximum Exposure
White King/Lucky Lass Mines Site
Lakeview, Oregon

Parameter	Receptor				
	Adult Recreational User (Current/Future)	Child Recreational User (Current/Future)	Worker (Current/Future)	Resident Adult (Future)	Resident Child (Future)
Incidental Ingestion of Stockpile Materials and Soil					
IR_s (mg/day)	50	200	50	100	200
ED (yrs)	24	6	25	24	6
EF (days/yr)	26	26	23	183	183
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Incidental Ingestion of Augur Creek Sediment					
IR_s (mg/day)	50	200	50	100	200
ED (yrs)	24	6	25	24	6
EF (days/yr)	13	13	4	13	13
BW (kg)	70	15	70	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Incidental Ingestion of Mine Pit Sediment					
IR_s (mg/day)	50	200	NA	100	200
ED (yrs)	24	6	NA	24	6
EF (days/yr)	12	12	NA	24	24
BW (kg)	70	15	NA	70	15
AT (days)	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)	NA	70x365 (carc.) EDx365 (noncarc.)	70x365 (carc.) EDx365 (noncarc.)
Inhalation of Radon Gas in Indoor Air					
IH (m^3/day)	NA	NA	NA	20	NA
ED (yrs)	NA	NA	NA	30	NA
EF (days/yr)	NA	NA	NA	365	NA
ET (hrs/day)	NA	NA	NA	16	NA

TABLE 7-8 (cont) –Exposure Parameter Values—Reasonable Maximum Exposure
White King/Lucky Lass Mines Site
Lakeview, Oregon
(Continued)

Parameter	Receptor				
	Adult Recreational User (Current/Future)	Child Recreational User (Current/Future)	Worker (Current/Future)	Resident Adult (Future)	Resident Child (Future)
Inhalation of Vapors from Groundwater					
tf (pCi/m^3 per pCi/L)	NA	NA	NA	0.5	0.5
External Exposure to Radionuclides in Soil					
ET (hr/day)	3	3	8	24	24
EF (days/yr)	26	26	23	350	350
ED (yrs)	24	6	9	24	6

NA - Not applicable
Carc. - Carcinogens
Noncarc. - Noncarcinogens

Table 7-9

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Arsenic	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	2nd Quarter, 1996
Radium-226	3.0E-10	3.0E-10	risk/pCi	A	HEAST	1995

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Arsenic	4.3E-3	$(ug/m^3)^{-1}$	1.5E+1	$(mg/kg\text{-}day)^{-1}$	A	IRIS	2nd Quarter, 1996
Radium-226	—	—	2.8E-9	risk/pCi	A	HEAST	1995

Pathway: External (Radiation)

Chemical of Concern	Cancer Slope or Conversion Factor	Exposure Route	Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Radium-226	6.7E-6	External	risk/pCi	A	HEAST	1995

Key

—: No information available
IRIS: Integrated Risk Information System, U.S. EPA
HEAST: Health Effects Assessment Summary Tables, U.S. EPA

EPA Group:

A - Human carcinogen
B1 - Probable human carcinogen - Indicates that limited human data are available
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Table 7-10

Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YYYY)
Arsenic	Chronic	3E-4	mg/kg-day	3E-4	mg/kg-day	skin	3	IRIS	2nd Quarter, 1996
Ra-226	—	—	—	—	—	—	—	—	—

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (MM/DD/YYYY)
Arsenic	—	—	—	—	—	—	—	—	—
Radium-226	—	—	—	—	—	—	—	—	—

Key

—: No information available
IRIS: Integrated Risk Information System, U.S. EPA

Table 7-11

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King Soil	Surface Soil	Arsenic	6.36E-5	3.76E-7	N/A	N/A	6.40E-5
		Surface Soil	Radium-226	6.52E-7	3.54E-9	N/A	2.66E-4	2.67E-4
							Soil risk total=	3.3E-4
							Total Risk =	3.3E-4

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-12

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King Soil	Surface Soil	Arsenic	1.21E-4	7.14E-7	N/A	N/A	1.22E-4
		Surface Soil	Radium-226	1.33E-07	3.54E-9	N/A	5.42E-5	5.43E-5
							Soil risk total=	1.76E-4
							Total Risk =	1.76E-4

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-13

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King/Lucky Lass Soil	Surface/Subsurface Soil	Arsenic	3.89E-4	9.04E-7	N/A	N/A	3.9E-4
		Surface/Subsurface Soil	Radium-226	5.99E-8	9.61E-10	N/A	2.29E-6	2.35E-6
							Soil risk total=	**3.92E-4**
Sediment	Auger Creek	Sediment	Arsenic	9.71E-6	N/A	N/A	N/A	9.71E-6
	White King Pond	Sediment	Arsenic	1.10E-5				1.10E-5
							Sediment risk total=	**2.07E-5**
Surface Water	Auger Creek	Surface Water	Arsenic	6.38E-6	N/A	N/A	N/A	6.38E-6
	White King Pond	Surface Water	Arsenic	3.61E-6	N/A	N/A	N/A	3.61E-6
							Surface-water risk total=	**9.99E-6**
							Total Risk =	**4.23E-4**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-14

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King/Lucky Lass Soil	Surface/Subsurface Soil	Arsenic	1.12E-4	4.76E-7	N/A	N/A	1.12E-4
		Surface/Subsurface Soil	Radium-226	1.77E-07	9.61E-10	N/A	6.77E-6	6.95E-6
							Soil risk total=	**1.19E-4**
Sediment	Auger Creek	Sediment	Arsenic	9.71E-6	N/A	N/A	N/A	9.71E-6
	White King Pond	Sediment	Arsenic	1.10E-5	N/A	N/A	N/A	1.10E-5
							Sediment risk total=	**2.07E-5**
Surface Water	Auger Creek	Surface Water	Arsenic	6.38E-6	N/A	N/A	N/A	6.38E-6
	White King Pond	Surface Water	Arsenic	3.61E-6	N/A	N/A	N/A	3.61E-6
							Surface-water risk total=	**9.99E-06**
							Total Risk =	**1.5E-4**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-15

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King Overburden Soil	Surface Soil	Arsenic	4.31E-3	5.45E-6	N/A	N/A	4.32E-3
		Surface Soil	Radium-226	3.83E-5	2.71E-8	N/A	4.49E-2	4.49E-2
							Soil Risk total=	**4.9E-2**
Groundwater	Shallow Groundwater	Tap Water	Arsenic	2.66E-1	N/A	N/A	N/A	2.66E-1
			Radon	N/A	1.36E-2	N/A	N/A	1.36E-2
							Groundwater Risk Total=	**2.79E-1**
Surface Water	Surface Water	White King Pond	Arsenic	6.18E-06	N/A	N/A	N/A	6.18E-6
			Radium-226	1.73E-08	N/A	N/A	N/A	1.73E-8
							Groundwater Risk Total=	**6.2E-6**
Sediment	Sediment	White King Pond	Arsenic	9.47E-6	N/A	N/A	N/A	9.47E-6
			Radium-226	2.42E-8	N/A	N/A	N/A	2.42E-8
							Sediment Risk Total=	**9.49E-6**
							Total Risk =	**3.28E-1**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-16

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	Lucky Lass Off-Pile Soil	Surface Soil	Arsenic	2.06E-6	N/A	N/A	N/A	2.06E-6
		Surface Soil	Radium-226	1.98E-7	8.61E-10	N/A	2.3E-4	2.3E-4
							Soil risk total=	**2.32E-4**
Groundwater	Lucky Lass Shallow Groundwater	Tap Water	Arsenic	5.92E-4	N/A	N/A	N/A	5.92E-4
			Radon	N/A	5.92E-4	N/A	N/A	5.93E-4
							Groundwater risk total=	**1.18E-3**
							Total Risk =	**1.33E-3**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-17

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	White King Overburden Soil	Surface Soil	Arsenic	1.00E-2	6.36E-6	N/A	N/A	1E-2
		Surface Soil	Radium-226	1.92E-5	6.76E-9	N/A	1.12E-2	1.12E-2
							Soil Risk Total=	**2.12E-2**
Groundwater	White King Shallow Groundwater	Tap Water	Arsenic	1.65E-1	N/A	N/A	N/A	1.65E-1
			Radon	N/A	3.4E-3	N/A	N/A	3.4E-3
							Groundwater Risk Total=	**1.68E-1**
Surface Water	White King Pond	Surface Water	Arsenic	7.21E-6	N/A	N/A	N/A	7.21E-6
			Radium-226	4.32E-09	N/A	N/A	N/A	4.32E-9
							Surface Water Risk Total=	**7.21E-6**
Sediment	White King Pond	Sediment	Arsenic	2.21E-5	N/A	N/A	N/A	2.21E-5
			Radium-226	1.21E-08	N/A	N/A	N/A	1.21E-8
							Sediment risk total=	**2.21E-5**
							Total Risk =	**1.89E-1**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-18

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Soil	Lucky Lass Off-Pile Soil	Surface Soil	Arsenic	4.18E-6	N/A	N/A	N/A	4.18E-6
		Surface Soil	Radium-226	9.88E-8	8.61E-10	N/A	5.78E-5	5.78E-5
							Soil risk total=	**6.2E-5**
Groundwater	Lucky Lass Shallow Groundwater	Tap Water	Arsenic	3.45E-4	N/A	N/A	N/A	3.45E-4
			Radon		1.22-4			1.22E-4
							Groundwater risk total=	**4.67E-4**
							Total Risk =	**5.2E-4**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-19

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	White King Soil	Surface/Sub surface Soil	Arsenic	skin	2.9E+0	N/A	N/A	2.9E+0
							Soil Hazard Index Total =	**2.9E+0**
Sediment	Auger Creek	Sediment	Arsenic	skin	2.52E-1	N/A	N/A	2.52E-1
	White King Pond	Sediment	Arsenic	skin	2.86E-1	N/A	N/A	2.86E-1
	Lucky Lass Pond	Sediment	Arsenic	skin	9.79E-3	N/A	N/A	9.79E-3
							Sediment Hazard Index Total =	**5.48E-1**
Surface Water	Auger Creek	Surface Water	Arsenic	skin	1.65E-1	N/A	N/A	1.65E-1
	White King Pond	Surface Water	Arsenic	skin	9.35E-2	N/A	N/A	9.35E-2
	Lucky Lass Pond	Surface Water	Arsenic	skin	1.28E-2	N/A	N/A	1.28E-2
							Surface-Water Hazard Index Total =	**2.71E-1**
							Receptor Hazard Index =	**3.7E+0**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-20

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	White King Soil	Surface/Subsurface Soil	Arsenic	skin	1.01E+1	N/A	N/A	1.01E+1
							Soil Hazard Index Total =	**1.01+1**
Sediment	Auger Creek	Sediment	Arsenic	skin	2.52E-1	N/A	N/A	2.52E-1
	White King Pond	Sediment	Arsenic	skin	2.86E-1	N/A	N/A	2.86E-1
	Lucky Lass pond	Sediment	Arsenic	skin	9.79E-3	N/A	N/A	9.79E-3
							Sediment Hazard Index Total =	**5.46E-1**
Surface Water	Auger Creek	Surface Water	Arsenic	skin	1.65E-1	N/A	N/A	1.65E-1
	White King Pond	Surface Water	Arsenic	skin	9.35E-2	N/A	N/A	9.35E-2
	Lucky Lass Pond	Surface Water	Arsenic	skin	1.28E-2	N/A	N/A	1.28E-2
							Surface-Water Hazard Index Total =	**2.71E-1**
							Receptor Hazard Index =	**10.8E+0**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-21

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	White King Soil	Surface Soil	Arsenic	skin	2.79E+1	N/A	N/A	2.79E+1
							Soil Hazard Index Total=	**2.79E+1**
Groundwater	White King Shallow Groundwater	Tap Water	Arsenic	skin	2.0E+3			2.0E+3
							Groundwater Hazard Index Total=	**2.0E+3**
							Receptor Hazard Index =	**2.03E+3**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-22

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Lucky Lass Off-Pile Soil	Surface Soil	Arsenic	skin	1.34E-2	N/A	N/A	1.34E-2
							Soil Hazard Index Total=	**1.34E-2**
Groundwater	Deep Bedrock Groundwater	Tap Water	Arsenic	skin	3.84E+0	N/A	N/A	3.8E+0
							Ground water Hazard Index Total=	**3.8E+0**
Surface Water	Lucky Lass Pond	Surface Water	Arsenic	skin	5.48E-3	N/A	N/A	5.8E-3
							Surface Water Hazard Index Total=	**5.8E-3**
Sediment	Lucky Lass Pond	Sediment	Arsenic	skin	2.10E-3	N/A	N/A	2.10E-3
							Sediment Hazard Index Total=	**2.10E-3**
							Receptor Hazard Index =	**3.82E+0**

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-23

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	White King Soil	Surface Soil	Arsenic	skin	2.61E+2	N/A	N/A	2.61E+2
							Surface Soil Hazard Index Total=	2.61E+2
Groundwater	White King Shallow Groundwater	Tap Water	Arsenic	skin	4.67E+3			4.67E+3
							Groundwater Hazard Index Total=	4.67E+3
							Receptor Hazard Index =	4.93E+3

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-24

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Lucky Lass Off-Pile Soil	Surface Soil	Arsenic	skin	1.25E-1	N/A	N/A	1.25E-1
							Soil Hazard Index Total =	1.25-1
Groundwater	Deep Bedrock Groundwater	Tap Water	Arsenic	skin	8.95E+0	N/A	N/A	8.95E+0
							Groundwater Hazard Index Total=	8.95E+0
							Receptor Hazard Index =	9.7E+0

Key

N/A: Route of exposure is not applicable to this medium.

Table 7-25
Occurrence, Distribution, and Selection of Chemicals of Concern (COC) Ecological Risk Assessment

Exposure Medium: Sediment - Auger Creek

Chemical of Potential Concern	Minimum Conc.[1] (ppm)	Maximum Conc.[1] (ppm)	Mean Conc. (ppm)	95 % UCL of the Mean [2] (ppm)	Background Conc. (ppm)	Screening Toxicity Value (ppm)	Screening Toxicity Value Source [3]	HQ Value [4]	COC Flag (Y or N)
Arsenic	25.4	159	103.6	159	4.2	6	Ont. LEL	2.65E+01	Y
Manganese	359	6090	2735	4459	1610	460	Ont. LEL	1.32E+01	Y

Key
Conc. = Concentration
—: No information available

Notes
[1] Minimum/ maximum detected concentration above the sample quantitation limit (SQL).
[2] The 95% Upper Confidence Limit (UCL) represents the RME concentration.
[3] Ont LEL = Ontario Lowest Effects Level Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. D. Persaud, R. Jaagumagi, and A. Hayton. Ontario Ministry of the Environment, Ontario, August 1993.
[4] Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.

Table 7-26
Occurrence, Distribution, and Selection of Chemicals of Concern (COC) Ecological Risk Assessment

Exposure Medium: Sediment - White King

Chemical of Potential Concern	Minimum Conc.[1] (ppm)	Maximum Conc.[1] (ppm)	Mean Conc. (ppm)	95 % UCL of the Mean [2] (ppm)	Background Conc. (ppm)	Screening Toxicity Value (ppm)	Screening Toxicity Value Source [3]	HQ Value [4]	COC Flag (Y or N)
Arsenic	196	196	196	196	—	6	Ont. LEL	3.27E+01	Y
Manganese	388	388	388	388	—	460	Ont. LEL	0.843	Y
Mercury	.97	.97	.97	.97	—	.20	Ont. LEL	4.85E+00	Y

Key
Conc. = Concentration
— : No information available

Notes
[1] Minimum/ maximum detected concentration above the sample quantitation limit (SQL).
[2] The 95% Upper Confidence Limit (UCL) represents the RME concentration.
[3] Ont LEL = Ontario Lowest Effects Level Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. D. Persaud, R. Jaagumagi, and A. Hayton. Ontario Ministry of the Environment, Ontario, August 1993.
[4] Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.

Table 7-27
Occurrence, Distribution, and Selection of Chemicals of Concern (COC) Ecological Risk Assessment

Exposure Medium: Surface water - White King Pond

Chemical of Potential Concern	Minimum Conc.[1] (ppm)	Maximum Conc.[1] (ppm)	Mean Conc. (ppm)	95 % UCL of the Mean [2] (ppm)	Background Conc. (ppm)	Screening Toxicity Value (ppm)	Screening Toxicity Value Source [3]	HQ Value [4]	COC Flag (Y or N)
Aluminum	NA	4.01	3.62	4.41	N/A	0.2	EPA SMCL & Aquatic Effects Level	20	Y
Arsenic	NA	0.128	.072	.14	.01	0.048	Oregon Water Quality Critera LOEL	2.7E+0	Y

Key
Conc. = Concentration
— : No information available

Notes
[1] Minimum/ maximum detected concentration above the sample quantitation limit (SQL).
[2] The 95% Upper Confidence Limit (UCL) represents the RME concentration.
[3] SMCL = Secondary MCL
[4] Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.

Table 7-28
Occurrence, Distribution, and Selection of Chemicals of Concern (COC) Ecological Risk Assessment

Exposure Medium: Surface/Subsurface Soil - White King

Chemical of Potential Concern	Minimum Conc.[1] (ppm)	Maximum Conc.[1] (ppm)	Mean Conc. (ppm)	95 % UCL of the Mean [2] (ppm)	Background Conc. (ppm)	Screening Toxicity Value (ppm)	Screening Toxicity Value Source	HQ Value [4]	COC Flag (Y or N)
Arsenic		13,794	1.04E+3	1.634E+3		10.0	ORNL [3]	1.38E+03	Y
Antimony		249E+0	4.133E+1	9.018E+1		1.40E-01	Chronic NOAEL[5]	4.84E+02	Y
Selenium		68.10E+0	4.747E+0	9.404E+0		1.0E+0	ORNL [3]	6.81E+01	Y
Mercury		64.30E+0	3.473E+0	6.091E+0		.30E+0	ORNL [3]	2.14E+02	Y

Key
Conc. = Concentration
— : No information available

Notes
[1] Minimum/ maximum detected concentration above the sample quantitation limit (SQL).
[2] The 95% Upper Confidence Limit (UCL) represents the RME concentration.
[3] Oak Ridge National Laboratory data file for plants - Will and Suter, 1994
[4] Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.
[5] Schroeder et al. 1970

Table 7-29 -Summary of Ecological Hazard Quotients and Associated Receptor Effects
White King/Lucky Lass Mining Site, Lakeview, Oregon
(continued)

Receptor/Analyte	White King				Lucky Lass				Augur Creek		Receptor Effects
	SS	SBS	SD	SW	SS	SBS	SD	SW	SD	SW	
Aquatic Invertebrates											
Arsenic			32.7				1.1		26.5		Decreased tolerance by benthic organisms
Cadmium									3		Decreased tolerance by benthic organisms
Copper							2				Decreased tolerance by benthic organisms
Iron			1.6				1.6				Decreased tolerance by benthic organisms
Manganese							1.6		13.2		Decreased tolerance by benthic organisms
Mercury			4.9								Decreased tolerance by benthic organisms
Nickel			1.1				1.1				Decreased tolerance by benthic organisms
Silver							1.4				Decreased tolerance by benthic organisms
Zinc									2.2		Decreased tolerance by benthic organisms
Cumulative Hazard			**40**				**9**		**45**		
Aquatic Biota											
Arsenic				2.7							Increased long-term sublethality in aquatic organisms
Iron				1.4				3			Increased long-term sublethality in aquatic organisms
Lead								1.8		6.9	Increased long-term sublethality in aquatic organisms
Mercury										21.7	Increased long-term sublethality in aquatic organisms
Cumulative Hazard				**4.1**				**4.8**		**28.6**	

Note: Unbolded numbers represent the hazard quotient value for the presented receptor, analyte, location, and medium. Bolded numbers represent the cumulative hazard quotient or hazard index for the presented receptor, location, and medium. A blank cell indicates that either the hazard quotient was less than 1.0 or no hazard quotients were calculated for that receptor and medium. Receptor effects were taken from the effect summary tables presented for each receptor (D.3-8, D.3-9, D.3-10, D.3-11, D.3-12/13). Effects for the community groups (i.e., plants, invertebrates, biota) had to be expressed as group effects rather than as individual effects as presented for the grouse, crane, and shrew.

SS - Surface soil
SD - Sediment
SBS - Subsurface soil
SW - Surface water

Table 7-29 --Summary of Ecological Hazard Quotients and Associated Receptor Effects
White King/Lucky Lass Mining Site, Lakeview, Oregon

Receptor/Analyte	White King				Lucky Lass				Augur Creek		Receptor Effects
	SS	SBS	SD	SW	SS	SBS	SD	SW	SD	SW	
Blue Grouse											
Arsenic	8.9	29.7									Behavioral abnormalities
Lead	1.7	6.4									*Reproductive and histopathological effects*
Mercury	1.8	22.3									Increased mortality
Selenium	26.5										Reproductive effects
Cumulative Hazard	**38.9**	**58.4**									
Greater Sandhill Crane											
Aluminum			51.8				56.3				Increased body weight/decreased growth/abnormal egg production
Iron			11.8				12.3				Increased mortality and decreased bone ash
Magnesium			1.4				5.5				Decrease in body weight and bone ash
Vanadium			2.4				1.9				Reproductive effects
Cumulative Hazard			**67.4**				**76**				
Vagrant Shrew											
Antimony	87.5	48.4									Increased mortality
Arsenic	310	1,030			1.1						Increased mortality/decreased body weight
Calcium					3.5						Changes in serum electrolytes and blood pressure
Lead	25,000	93,500									Genotoxicity or embryotoxicity
Selenium	49.4										Abnormal fetal growth
Thallium	1.1	3.6									Increased mortality
Cumulative Hazard	**25,448**	**94,582**			**4.6**						
Terrestrial Plants											
Antimony	9	49.8									Reduced or abnormal plant growth
Arsenic	414	1,380			1.5						Reduced or abnormal plant growth
Beryllium		1.1									Reduced or abnormal plant growth
Lead	2.8	10.3									Reduced or abnormal plant growth
Mercury	17.7	214									Reduced or abnormal plant growth
Selenium	68.1										Reduced or abnormal plant growth
Silver		2.1			3.4						Reduced or abnormal plant growth
Thallium	2.3	8									Reduced or abnormal plant growth
Cumulative Hazard	**514**	**1,665**			**5**						

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TABLE 8-1

WATER QUALITY CRITERIA SUMMARY
(Applicable to all Basins)[1]

The concentration for each compound listed in this chart is a criteria or guidance value* not to be exceeded in waters of the state for the protection of aquatic life and human health. Specific descriptions of each compound and an explanation of values are included in Quality Criteria for Water (1986). Selecting values for regulatory purposes will depend on the most sensitive beneficial use to be protected, and what level of protection is necessary for aquatic life and human health.

Compound Name (or Class)	Priority Pollutant	Carcinogen	Concentration in Micrograms Per Liter for Protection of Aquatic Life				Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
ACENAPTHENE	Y	N	*1,700.	*520.	*970.	*710.			
ACROLEIN	Y	N	*68.	*21.	*55.		320.ug	780.ug	
ACRYLONITRILE	Y	Y	*7,550.	*2,600.			0.058ug**	0.65ug**	
ALDRIN	Y	Y	3.0		1.3		0.074ng**	0.079ng**	
ALKALINITY	N	N		20,000					
AMMONIA	N	N	CRITERIA ARE pH AND TEMPERATURE DEPENDENT — SEE DOCUMENT USEPA JANUARY 1985 (Fresh Water) CRITERIA ARE pH AND TEMPERATURE DEPENDENT — SEE DOCUMENT USEPA APRIL 1989 (Marine Water)						
ANTIMONY	Y	N	*9,000.	*1,600.			146.ug	45,000.ug	
ARSENIC	Y	Y					2.2ng**	17.5ng**	0.05mg
ARSENIC (PENT)	Y	Y	*850.	*48.	*2,319.	*13.			
ARSENIC (TRI)	Y	Y	360.	190.	69.	36.			
ASBESTOS	Y	Y					30K f/L**		
BARIUM	N	N					1.mg		1.0mg
BENZENE	Y	Y	*5,300.		*5,100.	*700.	0.66ug**	40.ug**	
BENZIDINE	Y	Y	*2,500.				0.12ng	0.53ng**	
BERYLLIUM	Y	Y	*130.	*5.3			6.8ng**	117.ng**	
BHC	Y	N	*100.		*0.34				
CADMIUM	Y	N	3.9+	1.1+	43.	9.3	10.ug		0.010mg
CARBON TETRACHLORIDE	Y	Y	*35,200.		*50,000.		0.4ug**	6.94ug**	
CHLORDANE	Y	Y	2.4	0.0043	0.09	0.004	0.46ng**	0.48ng**	
CHLORIDE	N	N	860 mg/L	230 mg/L					
CHLORINATED BENZENES	Y	Y	*250	*50.	*160.	*129.	488.ug		
CHLORINATED NAPHTHALENES	Y	N	*1,600.		*7.5				
CHLORINE	N	N	19.	11.	13.	7.5			
CHLOROALKYL ETHERS	Y	N	*238,000.						
CHLOROETHYL ETHER (BIS-2)	Y	Y					0.03ug	1.36ug**	
CHLOROFORM	Y	Y	*28,900.	*1,240.			0.19ug**	15.7ug**	
CHLOROISOPROPYL ETHER (BIS-2)	Y	N					34.7ug	4.36mg	

WATER QUALITY CRITERIA SUMMARY (Continued)

Compound Name (or Class)	Priority Pollutant	Carcinogen	Concentration in Micrograms Per Liter for Protection of Aquatic Life				Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
CHLOROMETHYL ETHER (BIS)	N	Y					0.00000376ng**	0.00184ug**	
CHLOROPHENOL 2	Y	N	*4,380.	*2,000.					
CHLOROPHENOL 4	N	N			*29,700.				
CHLOROPHENOXY HERBICIDES (2,4,5,-TP)	N	N					10.ug		
CHLOROPHENOXY HERBICIDES (2,4-D)	N	N					100.ug		
CHLORPYRIFOS	N	N	0.083	0.041	0.011	0.0056			
CHLORO-4 METHYL-3 PHENOL	N	N	*30.						
CHROMIUM (HEX)	Y	N	16.	11.	1,100	50.	50.ug		0.05mg
CHROMIUM (TRI)	N	N	1,700.+	210.+	*10,300		170.mg	3,433.mg	0.05mg
COPPER	Y	N	18.+	12.+	2.9	2.9			
CYANIDE	Y	N	22.	5.2	1.	1.	200.ug		
DDT	Y	Y	1.1	0.001	0.13	0.001	0.024ng**	0.024ng**	
DDT METABOLITE (DDE)	Y	Y	*1,050.		*14.				
DDT METABOLITE (TDE)	Y	Y	*0.06		*3.6				
DEMETON	Y	N		0.1		0.1			
DIBUTYLPHTHALATE	Y	N					35.mg	154.mg	
DICHLOROBENZENES	Y	N	*1,120.	*763.	*1,970.		400.ug	2.6mg	
DICHLOROBENZIDINE	Y	Y					0.01ug**	0.020ug**	
DICHLOROETHANE 1,2	Y	Y	*118,000.	*20,000.	*113,000.		0.94ug**	243.ug**	
DICHLOROETHYLENES	Y	Y	*11,600.		*224.000.		0.033ug**	1.85ug**	
DICHLOROPHENOL 2,4	N	N	*2,020.	*365.			3.09mg		
DICHLOROPROPANE	Y	N	*23,000.	*5,700.	*10,300.	*3,040.			
DICHLOROPROPENE	Y	N	*6,060.	*244.	*790.		87.ug	14.1mg	
DIELDRIN	Y	Y	2.5	0.0019	0.71	.0019	0.071ng**	0.076ng**	
DIETHYLPHTHALATE	Y	N					350.mg	1.8g	
DIMETHYL PHENOL 2,4	Y	N	*2,120.						
DIMETHYL PHTHALATE	Y	N					313.mg	2.9g	
DINITROTOLUENE 2,4	N	Y					0.11ug**	9.1ug**	
DINITROTOLUENE	Y	N					70.ug	14.3mg	
DINITROTOLUENE	N	Y	*330.	*230.	*590.	*370.			
DINITRO-O-CRESOL 2,4	Y	N					13.4g	765.ug	
DIOXIN (2,3,7,8-TCDD)	Y	Y	*0.01	*38 pg/L			0.000013ng**	0.000014ng**	
DIPHENYLHYDRAZINE	Y	N					42.ng**	0.56ug**	

WATER QUALITY CRITERIA SUMMARY (Continued)

Compound Name (or Class)	Priority Pollutant	Carcinogen	Concentration in Micrograms Per Liter for Protection of Aquatic Life				Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
DIPHENYLHYDRAZINE 1,2	Y	N	*270.						
DI-2-ETHYLHEXYL PHTHALATE	Y	N					15.mg	50.mg	
ENDOSULFAN	Y	N	0.22	0.056	0.034	0.0087	74.ug	159.ug	
ENDRIN	Y	N	0.18	0.0023	0.037	0.0023	1.ug		0.0002mg
ETHYLBENZENE	Y	N	*32,000.		*430.		1.4mg	3.28mg	
FLUORANTHENE	Y	N	*3,980.		*40.	*16.	42.ug	54.ug	
GUTHION	N	N		0.01		0.01			
HALOETHERS	Y	N	*360.	*122.					
HALOMETHANES	Y	Y	*11,000.		*12,000.	*6,400.	0.19ug**	15.7ug**	
HEPTACHLOR	Y	Y	0.52	0.0038	0.053	0.0036	0.28ng**	0.29ng**	
HEXACHLOROETHANE	N	Y	*980.	*540.	*940.		1.9ug	8.74ug	
HEXACHLOROBENZENE	Y	N					0.72ng**	0.74ng**	
HEXACHLOROBUTADIENE	Y	Y	*90.	*9.3	*32.		0.45ug**	50.ug**	
HEXACHLOROCYCLOHEXANE (LINDANE)	Y	Y	2.0	0.08	0.16				0.004mg
HEXACHLOROCYCLOHEXANE-ALPHA	Y	Y					9.2ng**	31.ng**	
HEXACHLOROCYCLOHEXANE-BETA	Y	Y					16.3ng**	54.7ng**	
HEXACHLOROCYCLOHEXANE-GAMA	Y	Y					18.6ng**	62.5ng**	
HEXACHLOROCYCLOHEXANE-TECHNICAL	Y	Y					12.3ng**	41.4ng**	
HEXACHLOROCYCLOPENTADIENE	Y	N	*7.	*5.2	*7.		206.ug		
IRON	N	N		1,000.			0.3mg		
ISOPHORONE	Y	N	*117,000.		*12,900.		5.2mg	520.mg	
LEAD	Y	N	82.+	3.2+	140.	5.6	50.ug		0.05mg
MALATHION	N	N		0.1		0.1			
MANGANESE	N	N					50.ug	100.ug	
MERCURY	Y	N	2.4	0.012	2.1	0.025	144.ng	146.ng	0.002mg
METHOXYCHLOR	N	N		0.03		0.03	100.ug		0.1mg
MIREX	N	N		0.001		0.001			
MONOCHLOROBENZENE	Y	N					488.ug		
NAPHTHALENE	Y	N	*2,300.	*620.	*2,350.				
NICKEL	Y	N	1,400.+	160+	75	8.3	13.4ug	100.ug	
NITRATES	N	N					10.mg		10.mg
NITROBENZENE	Y	N	*27,000.		*6,680.		19.8mg		
NITROPHENOLS	Y	N	*230.	*150.	*4,850.				

WATER QUALITY CRITERIA SUMMARY (Continued)

Compound Name (or Class)	Priority Pollutant	Carcinogen	Concentration in Micrograms Per Liter for Protection of Aquatic Life				Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
NITROSAMINES	Y	Y	*5,850.		*3,300,000		0.8ng**	1,240 ng**	
NITROSODIBUTYLAMINE N	Y	Y					6.4ng**	587 ng**	
NITROSODIETHYLAMINE N	Y	Y					0.8ng**	1,240 ng**	
NITROSODIMETHYLAMINE N	Y	Y					1.4ng**	16,000.ng**	
NITROSODIPHENYLAMINE N	Y	Y					4,900.ng**	16,100.ng**	
NITROSOPYRROLIDINE N	Y	Y					16.ng**	91,900 ng**	
PARATHION	N	N	0.065	0.013					
PCB's	Y	Y	2.0	0.014	10.	0.03	0.079ng**	0.079ng**	
PENTACHLORINATED ETHANES	N	N	*7,240.	*1,100.	*390.	*281.			
PENTACHLOROBENZENE	N	N					74.ug	85.ug	
PENTACHLOROPHENOL	Y	N	***20.	***13.	13.	*7.9	1.01mg		
PHENOL	Y	N	*10,200.	*2,560.	*5,800.		3.5mg		
PHOSPHORUS ELEMENTAL	N	N				0.1			
PHTHALATE ESTERS	Y	N	*940.	*3.	*2,944.	*3.4			
POLYNUCLEAR AROMATIC HYDRO-CARBONS	Y	Y			*300.		2.8ng**	31.1ng**	
SELENIUM	Y	N	260.	35.	410.	54.	10.ug		0.01mg
SILVER	Y	N	4.1+	0.12	2.3		50.ug		0.05mg
SULFIDE-HYDROGEN SULFIDE	N	N		2.		2.			
TETRACHLORINATED ETHANES	Y	N	*9,320.						
TETRACHLOROBENZENE 1,2,4,5	Y	N					38.ug	48.ug	
TETRACHLOROETHANE 1,1,2,2	Y	Y		*2,400.	*9,020.		0.17ug**	10.7ug**	
TETRACHLOROETHANES	Y	N	*9,320.						
TETRACHLOROETHYLENE	Y	Y	*5,280.	*840.	*10,200.	*450.	0.8ug**	8.85ug**	
TETRACHLOROPHENOL 2,3,5,6	Y	N				*440.			
THALLIUM	Y	N	*1,400.	*40.	*2,130.		1.3 ug	48 ug	
TOLUENE	Y	N	*17,500.		*6,300.	*5,000.	14.3mg	424 mg	
TOXAPHENE	Y	Y	0.73	0.0002	0.21	0.0002	0.71ng**	0.73ng**	0.005mg
TRICHLORINATED EHANES	Y	Y	*18,000.						
TRICHLOROETHANE 1,1,1	Y	N			*31,2000.		18.4mg	1.03g	
TRICHLOROETHANE 1,1,2	Y	Y		*9,400.			0.6ug**	41.8ug**	
TRICHLOROETHYLENE	Y	Y	*45,000.	*21,900.	*2,000.		2.7ug**	80.7ug**	
TRICHLOROPHENOL 2,4,5	N	N					2,600 ug		
TRICHLOROPHENOL 2,4,6	Y	Y		*970.			1.2ug**	3.6ug**	

WATER QUALITY CRITERIA SUMMARY (Continued)

Compound Name (or Class)	Priority Pollutant	Carcinogen	Concentration in Micrograms Per Liter for Protection of Aquatic Life				Concentration in Units Per Liter for Protection of Human Health		
			Fresh Acute Criteria	Fresh Chronic Criteria	Marine Acute Criteria	Marine Chronic Criteria	Water and Fish Ingestion	Fish Consumption Only	Drinking Water M.C.L.
VINYL CHLORIDE	Y	Y					2.ug**	525.ug**	
ZINC	Y	N	120.+	110+	95	86			

MEANING OF SYMBOLS:

g = grams
mg = milligrams
ug = micrograms
ng = nanograms
pg = picograms
f = fibers
Y = Yes
N = No

M.C.L. = Maximum Contaminant Level
\+ = Hardness Dependent Criteria (100 mg/L used).
* = Insufficient data to develop criteria; value presented is the L.O.E.L. — Lower Observed Effect Level.
** = Human health criteria for carcinogens reported for three risk levels. Value presented is the 10-6 risk level, which means the probability of one concern case per million people at the stated concentration.
*** = pH Dependent Criteria (7.8 pH used).

1 = Values in Table 20 are applicable to all basins as follows:

Basin	Rule	Basin	Rule
North Coast	340-41-205(p)	Umatilla	340-41-645(p)
Mid Coast	340-41-245(p)	Walla Walla	340-41-685(p)
Umpqua	340-41-285(p)	Grande Ronde	340-41-725(p)
South Coast	340-41-325(p)	Powder	340-41-765(p)
Rogue	340-41-365(p)	Malheur River	340-41-805(p)
Williamette	340-41-445(p)	Owyhee	340-41-845(p)
Sandy	340-41-485(p)	Malheur Lake	340-41-885(p)
Hood	340-41-525(p)	Goose & Summer Lakes	340-41-925(p)
Deschutes	340-41-565(p)	Klamath	340-41-965(p)
John Day	340-41-605(p)		

Water and Fish Ingestion

Values represent the maximum ambient water concentration for consumption of both contaminated water and fish or other aquatic organisms.

Fish Ingestion

Values represent the maximum ambient water concentration for consumption of fish or other aquatic organisms.

SA\Table\WH5307.D

TABLE 9-1

Comparison of White King Pond Water Quality Following In-Situ Treatment with PRG and Ambient Water Quality Criteria (AWQC) White King/Lucky Lass Mines Site Lakeview, Oregon

Analytes	Preliminary Remediation Goals	AWQC* Freshwater Chronic	White King Pond Average Dissolved Concentration[d]
PH	6.5 - 9.0	7.0 - 9.0	7.4
Total Inorganics (mg/L)			
Aluminum	0.2[e]	N/A	0.078
Antimony	NE	1.6	0.025 U
Arsenic	0.036[e]/0.033[f]	0.19 [a]	0.014
Barium	NE	N/A	0.020
Beryllium	NE	0.0053 [b]	0.0017 U
Cadmium	NE	0.0011 [c]	0.0017 U
Chromium	NE	0.011	0.0054 U
Cobalt	NE	N/A	0.026
Copper	NE	0.012 [c]	0.0058 U
Iron	NE	1.0	0.16 U
Lead	NE	0.0032 [c]	0.0065 U
Manganese	NE	N/A	0.58
Mercury	NE	0.000012	0.000053 U
Nickel	NE	0.16 [c]	0.045
Selenium	NE	0.035	0.0059 U
Silver	NE	0.00012	0.0057 U
Thallium	NE	0.040 [c]	0.0097 U
Vanadium	NE	N/A	0.0028 U
Zinc	NE	0.11 [c]	0.049

* EPA, 1986, Oregon Regulation 340.41; Ambient Water Quality Criteria. These criteria are provided for comparison purposes only. Basin standards may have been developed to address uses and exposures that are different from those associated with White King Pond.

N/A – Not available.
NE – Not established.

[a] Trivalent arsenic standard is used in lieu of total arsenic standard.
[b] Insufficient data to develop criteria; value presented is the Lowest Observed Effects Level.
[c] Hardness dependent criteria (100 mg/l used).
[d] Dissolved concentrations are used for comparison because the total analyses are not relevant as risk is related only to dissolved arsenic in water (WESTON, 1999b).
[e] PRG for White King Mine pond water.
[f] PRG for Augur Creek surface water

U - Undetected.

TABLE 10-1

DETAILED ANALYSIS OF ALTERNATIVES - COST SUMMARY
WHITE KING/LUCK LASS MINES SITES
LAKEVIEW, OREGON

Alternatives	Capital/Construction Cost	Annual O&M Cost	Present Worth of 30 Year O&M Cost	PW of Incremental Cost for Perpetual Care	Total Present Worth Cost (30 year O&M)
White King Mine Stockpile					
SP-2[a]	$509,000	$36,000	$447,000	$67,000	$956,000
SP-3a[a]	$4,316,000	$68,000	$844,000	$127,000	$5,160,000
SP-3b[a]	$6,249,000	$54,000	$670,000	$101,000	$6,919,000
SP-4a[b]	$10,828,000	$55,000	$682,000	$104,000	$11,510,000
SP-4d[b]	$11,314,000	$55,000	$682,000	$104,000	$11,996,000
SP-5[b]	$26,116,000	$61,300	$724,000	$152,000	$26,840,000
White King Pond Water					
WKPW-2	$58,000	$18,000	$223,000	$34,000	$281,000
WKPW-3	$58,000	$55,000	$682,000	$104,000	$740,000
WKPW-4	$1,624,000	$0	$0	$0	$1,624,000
WKPW-5a	$1,664,000	$0	$0	$0	$1,664,000
WKPW-5b	$891,000	$0	$0	$0	$891,000
WKPW-6a	$1,731,000	$0	$0	$0	$1,731,000
WKPW-6b	$1,011,000	$0	$0	$0	$1,011,000
Lucky Lass Mine Stockpiles					
LL-2	$169,000	$15,000	$186,000	$28,000	$355,000
LL-3	$349,000	$15,000	$186,000	$28,000	$535,000
LL-4[c]	$2,656,000	$9,000	$112,000	$17,000	$2,768,000

Notes:

[a]Implementing these alternatives would also require implementing WKPW-2 or -3

[b]Implementing these alternatives would also require implementing WKPW-4, 5a, 5b, 6a, or 6b

[c]Incremental cost of moving Lucky Lass stockpiles and combining with the Alternative SP-5.

Table 11-1
WHITE KING MINE WASTE STOCKPILES Alternative SP- 3b (Revised Weston Estimate)

Captial Costs for SP-3b

Description	Quantity	Unit	Unit Rate	Total Cost
Mobilization/Demobilization	1	Job	$ 29,000.00	$ 29,000
Sub-Total				**$ 29,000**
Site Preparation/Improvements				
Temporary Facilities	1	Job	$ 14,000.00	$ 14,000
Haul Roads	1	Job	$ 28,000.00	$ 28,000
USFS Road Improvements	1	Job	$ 30,000.00	$ 30,000
Environmental Controls	1	Job	$ 32,000.00	$ 32,000
Sub-Total				**$ 104,000**
Institutional Controls				
Physical restrictions	6,000	LF	$ 20.00	$ 120,000
Land use Restrictions	4	Parcel	$ 10,000.00	$ 40,000
Monitoring well installation	80	LF	$ 90.00	$ 7,200
Sub-Total				**$ 167,200**
Cover & Consolidation on Protore Stockpile				
Excavate & place Protore off-pile & soil for 25' setback from creek	137,955	CY	$ 3.00	$ 413,865
Excavate & place overburden stockpile	455,000	CY	$ 4.00	$ 1,820,000
Cover:				
Vegetation	21	Acres	$ 2,500.00	$ 52,500
Top soil	8,181	CY	$ 10.00	$ 81,810
Cover soil	40,907	CY	$ 6.00	$ 245,442
Barrier - Erosion resistant rock	16,363	CY	$ 14.00	$ 229,082
Restoration of USFS Borrow Source	2	Acres	$ 7,000.00	$ 14,000
Sub-Total				**$ 2,856,699**
Temporary & Final Reclamation				
Temp Reclamation following 1st Const season				
Temp Regrading & Erosion control at overburden stockpile	26	Acres	$ 1,000.00	$ 26,000
Temp Regrading & Erosion control at Protore stockpile	21	Acres	$ 1,000.00	$ 21,000
Temp Regrading & Erosion control in off pile areas	21	Acres	$ 1,000.00	$ 21,000
Final Reclamation following 1st Const season				
Final Regrading & Vegetation of overburden stockpile	26	Acres	$ 7,000.00	$ 182,000
Temp Regrading & Vegetation on Off pile areas	21	Acres	$ 7,000.00	$ 147,000
Sub-Total				**$ 397,000**
Stormwater Management System				
French Drain (see attached estimate)	1,800	LF	$ 60.00	$ 108,000
Drainage Swales (4' wide) total 2,700 LF				
Excavation	420	CY	$ 3.00	$ 1,260
Geotextile (10 oz/sy)	1,500	SY	$ 1.35	$ 2,025
Rip Rap (6"thick)	250	CY	$ 14.00	$ 3,500
Drainage Swales (8' wide) total 2,700 LF				
Excavation	1,200	CY	$ 3.00	$ 3,600
Geotextile (10 oz/sy)	3,000	SY	$ 1.35	$ 4,050
Rip Rap (8"thick)	700	CY	$ 14.00	$ 9,800

Table 11-1
WHITE KING MINE WASTE STOCKPILES Alternative SP- 3b (Revised Weston Estimate)

Description	Quantity	Unit	Unit Rate	Total Cost
Sub-Total				**$ 132,235**
Construction Cost Sub-Total				**$ 3,686,134**
Engineering/Design (6% of Const. Cost)	1	Job	$ 221,168.00	$ 221,168
Sub-Total				**$ 221,168**
Contractor Procurement(s)	1	Job	$ 50,000.00	$ 50,000
Sub-Total				**$ 50,000**
Local Requirements	1	Job	$ 25,000.00	$ 25,000
Sub-Total				**$ 25,000**
Construction Management (2 Construction Seasons)				
Resident Engineering	2,640	Hour	$ 80.00	$ 211,200
Construction Manager	2,640	Hour	$ 80.00	$ 211,200
Health & Safety Officer	2,640	Hour	$ 80.00	$ 211,200
Assistant to Health Physicist	1,440	Hour	$ 50.00	$ 72,000
Confirmation Sampling	1	Job	$ 7,500.00	$ 7,500
Construction Technician (Compaction Testing)	768	Hour	$ 45.00	$ 34,560
Cover QA/QC Testing	21	Acre	$ 4,000.00	$ 84,000
Surveying	1	Job	$ 15,000.00	$ 15,000
Health & Safety Monitoring	1	Job	$ 45,500.00	$ 45,500
Post Const Documentation & Certification	1	Job	$ 36,000.00	$ 36,000
Home Office Allocation (5%)	1	Job	$ 93,650.00	$ 93,650
Sub-Total				**$ 1,021,810**
Contractor Management (2 Construction Seasons)				
Superintendent (8 mon 10hrs/day, 4 mon 8/day)	2,464	Hour	$ 55.00	$ 135,520
Foreman	2,464	Hour	$ 55.00	$ 135,520
Sub-Total				**$ 271,040**
Sub-Total Capital Construction				**$ 5,275,152**
Allowance for Contractor Change Orders (10%)				$ 527,515
Contingency (10%)				527,515.20
TOTAL ESTIMATE				**$ 6,330,182**

Annual Operation and Maintenance Cost for SP-3b

Transportation to Site for Monitoring	1	Trip	$ 2,100.00	$ 2,000.00
Per Diem and Car Rental Cost for Monitroing	9	man-days	$ 200.00	$ 1,800.00
Heatlh and Safety Monitoring	3	days	$ 150.00	$ 500.00
Monitoring Well Sampling and Analysis	6	sample	$ 150.00	$ 1,000.00
Augur Creek Monitoring (water and sediments)	6	sample	$ 150.00	$ 1,000.00
Sign Replacement	1	LS		$ 1,000.00
Mobilization for O&M of Cover System	Job	Estimate		$ 5,000.00
Fence Repair/Replacement	300	LF	$ 20.00	$ 6,000.00
Vegetation Replacement	1.25	Acres	$ 2,500.00	$ 3,000.00
Top-Soil Cover Repair	500	CY	$ 12.00	$ 6,000.00

Table 11-1
WHITE KING MINE WASTE STOCKPILES Alternative SP- 3b (Revised Weston Estimate)

Description	Quantity	Unit	Unit Rate	Total Cost
Stormwater Management System Maintenacne	Job	Estimate		$ 1,000.00
Former Stockpile Revegetation	1.3	Acres	$ 3,000.00	$ 4,000.00
Semi-Annual Site Inspections	2	Day	$ 1,210.00	$ 2,000.00
Annual Documentation Report	Job	Estimate		$ 5,000.00
Annualized cost for 5-year Review	Job	Estimate		$ 4,000.00
				$ 43,300.00
Contingency (10%)				$ 4,330.00
Annual O&M Cost (with 10% contingency)				**$ 47,630.00**
PRESENT WORTH OF ANNUAL O&M OVER 30 YEAR POST-CLOSURE				**$ 256,691.00**
PW OF INCREMENTAL COST FOR PERPETUAL CARE (a 15% increase)				$ 38,503.00
TOTAL PRESENT WORTH (Capital/Construction/Annualized O&M)				**$ 6,625,376.40**

Notes

Costs are estimates based on setback of Protore Stockpile from Augur Creek and a 24 inch soil cover as calculated by Jacobs Engineering for the U.S. Forest Service. Assumptions are the same as developed in the FS (Appendix I Table 2). O&M is based on FS estimate for Cover Option A (12 inches of soil). Other major assumptions are: Two 5.5 month constructions seasons, cover replacement 5% of total cover annuallly, and discount rate of 7% and a 30 year operating life.

Table 11-2
LUCKY LASS STOCKPILES
Alternative LL-3

Capital Costs for Lucky Lass Stockpile Alternative LL-3

Description	Quantity	Unit	Unit Rate	Total Cost
Mobilization/Demobilization	Job	Estimate		$ 5,000
Sub-Total				**$ 5,000**
Site Preparation/Improvements				
Temporary Facilities	Job	Estimate		$ 5,000
Haul Roads	Job	Estimate		$ 14,000
Environmental Controls	Job	Estimate		$ 5,000
Sub-Total				**$ 24,000**
Institutional Controls				
Physical Restrictions	1	LS	$ 2,000.00	$ 2,000
Land Use Restrictions	1	Parcel	$ 10,000.00	$ 10,000
Sub-Total				**$ 12,000**
Excavate/Remove Material above PRGs				
Excavate & Place Material at White King mine	3000	CY	6	$ 18,000
Restore Excavations				
Vegetation	2	Acres	$ 2,500.00	$ 5,000
Backfill Excavations	3,000	CY	$ 6.00	$ 18,000
Top Soil	500	CY	$ 10.00	$ 5,000
Riprap Protection along Lucky Lass Discharge	400	CY	$ 14.00	$ 6,000
Sub-Total				**$ 52,000.00**
Reclaim Stockpiles				
Regrade East and West Stockpile	10,000	CY	$ 3.00	$ 30,000
Topsoil	3,500	CY	$ 10.00	$ 35,000
Vegetation	8	Acres	$ 2,500.00	$ 20,000.00
Sub-Total				**$ 85,000**
CONSTRUCTION COST SUBTOTAL				**$ 178,000.00**
Engineering Design	Job	Estimate	10000	$ 25,000.00
Contractor Procurement	Job	Estimate	5000	5000
Local Requirements	Job	Estimate	5000	5000
Construction Management (one season)				
Resident Engineer	240	hour	$ 80.00	$ 19,000.00
Surveying	Job	Estimate	$ 2,500.00	$ 2,500.00
Health and Safety Monitoring	Job	Estimate	$ 1,000.00	$ 1,000.00
Post-Construction Documentation and Certificatio	Job	Estimate	$ 1,000.00	$ 1,000.00
Home Office Allowance (10%)	Job	Estimate	$ 2,350.00	$ 26,000.00
Contractor Management (Superintendent)	240	hour	$ 80.00	$ 19,000.00
SUBTOTAL (Capital and Construction)				**$ 258,000.00**

Table 11-2
LUCKY LASS STOCKPILES
Alternative LL-3

Description	Quantity	Unit	Unit Rate	Total Cost
ALLOWANCE FOR CONTRACTOR CHANGE ORDERS (10%)				$ 26,000.00
Contingency (25%)				$ 65,000.00
TOTAL ESTIMATE (CAPITAL/CONSTRUCTION) with Contingency				**$349,000**

Annual Operation and Maintenance Cost for WKPW-3

Mobilization for O&M of Cover System	Job	Estimate		$ 2,000.00
Sign Replacement	1	LS	$ 500.00	$ 500.00
Semi-Annual Site Inspections	2	Day	$ 1,210.00	$ 2,000.00
Vegetation Replacement	0.5	acres	$ 2,500.00	$ 1,000.00
Top-Soil Cover Repair	200	CY	$ 12.00	$ 2,000.00
Annual Documentation Report	Job	Estimate		$ 2,000.00
Annualize cost for 5-year review	Job	Estimate		$ 2,000.00
Sub-Total				**$ 12,000.00**
CONTINGENCY (25%)				**$ 3,000.00**
Annual O&M Cost (with 25% contingency)				**$ 15,000.00**
PRESENT WORTH OF ANNUAL O&M OVER 30 YEAR POST-CLOSURE				**$ 186,000.00**
TOTAL PRESENT WORTH (Capital/Construction/Annualized O&M)				**$ 535,000.00**

Notes: O&M Assumes a discount rate of 7% and a 30 year operating life.

Table 11-3
White King Pond Water Alternative WKPW-3

Captial Costs for WKPW-3

Description	Quantity	Unit	Unit Rate	Total Cost
Mobilization/Demobilization	Job	Estimate		$ 5,000
Sub-Total				**$ 5,000**
Institutional Controls				
Land Use Restrictions	1	Parcel	$ 10,000.00	$ 10,000
Monitoring Well Installation	80	LF	$ 90.00	$ 7,200
Sub-Total				**$ 17,200**
CONSTRUCTION COST SUBTOTAL				**$ 22,200**
Engineering Design	Job	Estimate	$ 3,000.00	$ 3,000
Contractor Procurement	Job	Estimate	$ 1,000.00	$ 1,000
Local Requirements	Job	Estimate	$ 10,000.00	$ 1,000
Contruction Management				
Resident Engineer	60	Hour	$ 80.00	$ 5,000
Surveying	Job	Estimate		$ 2,500
Health and Safety Monitoring	Job	Estimate		$ 2,500
Post-Consturinton Documentation and Certification	Job	Estimate		$ 2,000
Home Office Allowance	Job	Estimate		$ 1,200
Sub-Total				**$ 13,200**
Contractor Management				
Superintendent	60	hour	$ 55.00	$ 3,300
SUBTOTAL (Captial and Construction)				$ 4,000
ALLOWANCE FOR CONTRACTOR CHANGE ORDERS (10%)				
Allowance for Contractor Change Orders (10%)				
Contingency (25%)				
TOTAL ESTIMATE (CAPITAL/CONSTRUCTION) with Contingency				**$ 58,000.00**

Annual Operation and Maintenance Cost for WKPW-3

Managemtn of Pond Water	Job	Estimate	$ 30,000.00	$ 30,000.00
Transportation to Site for Monitoring	1	Trip	$ 2,100.00	$ 2,000.00
Per Diem and Car Rental Cost for Monitroing	9	Man-Days	$ 200.00	$ 1,800.00
Heatlh and Safety Monitoring	3	Days	$ 150.00	$ 500.00
Monitoring of Pond Water	3	Sample	$ 80.00	$ 200.00
Monitoring Well Sampling and Analysis	6	Sample	$ 150.00	$ 1,000.00
Semi-Annual Site Inspections	2	Days	$ 1,210.00	$ 2,000.00
Annual Documentation Report	Job	Estimate	$ 2,000.00	$ 2,000.00
Annuualize cost for 5-year review	Job	Estimate	$ 4,000.00	$ 4,000.00
Sub-Total				**$ 43,500.00**
CONTINGENCY (25%)				**$ 11,000.00**
Annual O&M Cost (with 25% contingency)				**$ 54,500.00**
PRESENT WORTH OF ANNUAL O&M OVER 30 YEAR POST-CLOSURE				**$ 682,000.00**
TOTAL PRESENT WORTH (Capital/Construction/Annualized O&M)				**$ 740,000.00**

APPENDIX C
PART 3: RESPONSIVENESS SUMMARY
WHITE KING/LUCKY LASS
SUPERFUND SITE

The responsiveness summary addresses public comments on the proposed plan for the White King/Lucky Lass site. The proposed plan was issued on September 29, 1999. The public comment period was held from October 1, 1999 to January 10, 2000, including a two 30-day extension. A public meeting was held in Lakeview, Oregon on October 14, 1999 to present the proposed plan and to accept oral and written public comments. Additional information on the community involvement for this site is discussed in Section 3 of the ROD.

OVERVIEW

The U.S. Environmental Protection Agency (EPA) distributed a Proposed Plan for remedial action at the White King/Lucky Lass site near Lakeview, Oregon. The Proposed Plan identified the preferred remedial alternative for the site. The major components of the proposed remedial alternative for White King/Lucky Lass presented in the Proposed Plan were as follows:

- Containment and Consolidation of the Overburden Stockpile with the Protore Stockpile with a 24 inch cap (12 inches of soil and 12 inches of rock)
- Continued neutralization/monitoring of the White King Pond
- Removal of Soils at the Lucky Lass site which exceed remediation levels and consolidation with the White King stockpiles
- Long term maintenance, monitoring, and institutional controls

EPA received oral comments on the Proposed Plan during the October 14, 1999, public meeting in Lakeview, and seven letters during the public comment period from October 1, 1999, through January 10, 2000. EPA also received 59 pages of comments from Kerr McGee and 151 pages of attachments on the Proposed Plan. Due to the limited number of oral and written comments from community members these comments are presented individually followed by EPA's response. The comments received from Kerr McGee are paraphrased and organized into categories based on the comment.

SUMMARIZED COMMUNITY COMMENTS

Verbal Comments During the Public Meeting

Comment: *A person familiar with the operation of the mine stated that the contractors working on the open pit had no knowledge of the level of radioactivity in each truck load and randomly disposed of materials using both stockpiles. Given the mix of materials in the stockpiles how will they be monitored?*

Response: The remedial action will consolidate the overburden and protore stockpiles into a single mine waste repository with a two-foot thick soil cover. There will be no attempt to

separate higher level radioactivity from lower levels within the stockpile materials. Monitoring will be conducted of ground water, sediment, and surface water to ensure that contaminants are not migrating into Augur Creek. Air monitoring will also be conducted during the remedial action to ensure there are no impacts to air or workers. Long-term inspection and maintenance of the repository will be conducted to ensure that it remains protective.

Comment: *How will equipment decontamination be handled during this project?*

Response: The Remedial Design will include plans for decontaminating equipment and preventing the spread of contamination off the site. The contaminants at the site can be easily removed from vehicles and equipment using conventional washing techniques.

Comment: *Who has been conducting the monitoring of the White King Pond and the addition of limestone?*

Response: This work has been conducted by the Kerr McGee Corporation, with oversight by EPA, ODEQ, USFS, and OOE.

Comment: *Has an area been identified that would provide cover soil or rock for the project?*

Response: No. The remedial design will identify the criteria for this material and potential sources in the area.

Comment: *The levels of arsenic in the Goose Lake valley are higher than at the mine sites, particularly at Hunters Lodge and nearby residences. What is either EPA or DEQ doing to address this "hazard"?*

Response: Drinking water in this area would only be tested and regulated if it serves through a "public water system". Public water systems are those that serve more than 10 individuals.

These are regulated by the Oregon Health Division under the Federal Safe Drinking Water Act and Oregon's Administrative Rules Section 333-61. For example, the City of Lakeview's water is required to be tested with results being submitted and available at the Health Division. More information about these systems and any test results could be obtained from the Drinking Water Section of the Oregon Health Division at (503) 731-4010 or http://www.ohd.hr.state.or.us/dwp/docs.

Owners of private domestic wells are only required to sample for coliform bacteria and nitrates as part of a real estate transaction in accordance OAR 333-061-0305 to 333-061-0335. EPA and DEQ encourage all individual well users to have their wells tested and to respond to test results appropriately to protect themselves from naturally occurring contaminants found in the area such as arsenic and radionuclides. It is the homeowners responsibility for the testing as the state or EPA is not able to fund statewide private well sampling.
The Hot Springs at Hunter's Lodge would be considered a recreational area. The standards for waters that are used for swimming and recreation are also regulated by the Oregon Health Division. The Environmental Services Section of the Health Division can be contacted at (503) 731-4012 regarding any health concerns or testing of surface waters used for recreation. Recreational uses are not the jurisdiction of DEQ or EPA.

Comment: *There are elevated levels of uranium throughout the area of the site and it seems that putting a fence around the stockpiles would be adequate to address any "potential" risks.*

Response: Alternative SP-2 provides a fence (or barrier) to prevent access by medium-to-large mammals, domestic cattle, and humans; however, it does not provide protection for small mammals or prevent erosion and the protectiveness depends on the effectiveness of physical and land-use restrictions. It also would not comply with State of Oregon requirements prohibiting disposal of radioactive material in a floodplain of a river or creek.

Comment: *What happens when wildlife or livestock ingest the water in the pond?*

Response: Historically the White King Pond water has had a pH around 4-5. Except for effects on some aquatic life EPA is not aware of any particular toxic effects on livestock or wildlife from consumption of acidic water. EPA's main concern at this time is with contaminants in the pond sediments and whether they are toxic or can lead to bioaccumulation in aquatic organisms. The ROD requires further evaluation of the sediments to assess the toxicity and bioaccumulation potential of contaminants in order to evaluate the risks and feasibility of environmental protection for the proposed beneficial uses (primarily aquatic habitat). In the short-term

livestock watering and recreational use will be restricted by fences while the neutralization efforts and sediment evaluation are being conducted and evaluated.

Comment: *Will the government conduct monitoring of the site in the future?*

Response: Yes. While a contractor will likely conduct the inspection, maintenance, and monitoring required at the site both the state and federal agencies will conduct oversight of these activities for an indefinite period of time. In addition since contaminated materials will remain on site EPA will be required to conduct a detailed review of the effectiveness of the remedy within five years of implementation of the remedy.

Comment: *Either consolidation of the stockpiles or leaving them in place seem like reasonable alternatives. Relocation of the material to another location seems like an unnecessary expense.*

Response: Comment noted. The selected remedy does not relocate the material to another location off-site but does move the material in order to meet State of Oregon requirements for disposal of radioactive material.

Comment: *The level of radiation currently at the site is no greater than what can be found in other areas near the site like in Thomas Creek.*

Response: EPA acknowledges there are probably other areas of radiological mineralization in the area. Those areas that have not been disturbed will not be cleaned up. Generally, the intent is to return the White King Lucky Lass Mines site to either acceptable risk or background levels. Under premining conditions, radiological materials were in the bedrock beneath layers of soil and subsoil. These materials have now been exposed at the surface and need to be consolidated and covered so that they cannot be dispersed above grade by man, animals, or natural erosive processes.

Comment: *The level of radiation at the mine site is lower now, due to the extraction of the uranium, than when it was mined and the levels of radiation are no different from what can be found naturally in other areas near the site. The site has been in its current condition for 35 years with no apparent harmful effects. Why take action at all?*

Response: The levels of radiation in stockpiles and surface soils are not at background. Background is based on levels that are found naturally in the vicinity of the Mines Site which have not been disturbed by mining activity. As stated in the previous response contaminated

soils have been exposed at the surface where there was previously soil and subsoil cover. Radium-226 and arsenic in these soils and stockpiles exceed background soil concentrations. The selected remedy is based on the remedial actions that are necessary to prevent exposure and unacceptable risk.

Comment: *How is consideration of current and future costs factored into the proposed project?*
Response: Current costs are based on the capital costs of remediation. Future costs are based on the cost of long-term inspection and maintenance. These are projected for thirty years at a 7% discount rate using the present worth financial model. According to present worth, a sum of money is held in escrow, and future costs are defrayed by compounding interest on the sum.

Comment: *How will the meadow be restored when the stockpiles are moved?*

Response: The selected remedy (SP-3b) will move the overburden stockpile to be co-located with the protore pile in a single mine waste repository. The meadow will be restored in accordance with Oregon mined land reclamation requirements. Revegetation of all disturbed areas will be done so it is comparable in stability and utility to adjacent areas. The dominant herbaceous community within the undisturbed wetlands consists of a combination of hairgrass-sedge moist meadows, sedge-wet meadows, and low sagebrush/bluegrass meadows.

Comment: *The White King stockpile Alternative 3 is acceptable and would seem to cause little disturbance.*

Response: The EPA, Federal and State Agencies have reached the same conclusion. Alternative SP-3b provides the greatest measure of long-term effectiveness because of reduced maintenance due to a thicker effective cover and it meets the State of Oregon requirements for disposal of radioactive material.

Comment: *Kerr McGee has a great deal of knowledge and experience with this site and other mines. It is hoped that the agencies listen and give consideration to their suggestions.*

Response: The Agencies appreciate input from community members and agree that Kerr McGee has specific knowledge and experience related to this site. EPA's responses to Kerr McGee's comments are found later in this document.

Comment: *There has been a great deal of discussion about the floodplain of Augur Creek. True flooding occurs at lower elevations in a watershed and not at higher elevations such as at this*

site. If damage from erosion was going to occur at the site it would have been seen by now. Over the years there has been little movement of the stockpiles.

Response: White it is true that Augur Creek does not have the erosive potential of larger streams at lower elevations there is evidence of erosion on the stockpiles which is likely the result of wind and water erosion. The extent of this erosion due to the influence of Augur creek cannot be determined. This is particularly evident at the Overburden stockpile where Augur Creek runs parallel to the stockpile.

Written Comments

Comment: *How will the water levels in the White Kings' pond be maintained to keep a consistent pH?*

Response: The water level in the White King pond fluctuates very little throughout the year. The primary factor in controlling the pH will the availability of material to buffer the acidity. Periodic addition of acid neutralizing material such as limestone rock should maintain a neutral pH in the White King pond. Monitoring of the pH will occur to determine the effectiveness of the neutralization efforts in order to make adjustments in the type and quantity of neutralizing agent to be added to the pond.

Comment: *How frequently will the White King pond, Augur creek, and the site soils be tested?*

Response: Ground water, surface water, and sediment monitoring and evaluation will be conducted as part of the remedy. The monitoring frequency will be determined during the remedial design but will occur at a minimum of once per year. Since the levels of contamination in the site soils are not expected to change over time no further soil sampling is planned once the remedial action is complete.

Comment: *It will take more than barbed wire fencing to keep the public off the site.*

Response: EPA agrees that fencing alone will not provide adequate protection from contaminated soils and therefore the remedy includes a soil cover over the mine waste repository.

Comment: *What kind of protection will be provided to workers during and after the cleanup?*

Response: The Remedial Design will include development of a site-specific health and safety

plan. This plan will identify potential risks and actions necessary to protect workers during the site cleanup and long term inspection and maintenance program. Typical protection measures may include dust control measures, personal protection clothing and equipment (such as safety glasses, ear plugs, respirators etc.) and monitoring of worker exposures. Oregon OSHA regulations also provide for protection measures for worker safety.

Comment: *Who will be in charge of the project EPA, the Forest Service, or both?*

Response: While EPA had the lead for development of the Record of Decision both EPA and the Forest Service share a responsibility for overseeing the implementation of the remedy. In addition the Oregon Office of Energy and Oregon Department of Environmental Quality are support agencies and will also be involved in overseeing the remedial design, remedial action, and long-term inspection and maintenance program.

Comment: *The sensible solution is to post the mines to trespass and inform the public that the mines are not as hazardous as they have been led to believe.*

Response: Institutional controls or physical access restrictions alone will not provide adequate protection to the public over the long term nor will it meet the Oregon rules for the disposal of radioactive material. Additional actions are required to reduce the risks and prevent erosion and impacts to surface and ground water.

Comment: *Alternative 3 seems to be an acceptable option as it does not require moving soil or disturbing too much other ground at the site.*

Response: Comment noted.

Comment: *Oregon DEQ supports Alternative SP-3b for the White King Stockpiles and considers this alternative to be the most feasible remedial action under application of Oregon environmental cleanup rules and statute. The alternative needs to continue to address important elements of Oregon's Cleanup statues and rules including protection of the beneficial uses of groundwater and surface water and meeting DEQ acceptable risks levels. The ROD should state the cover design expectations and/or set forth specific minimum design standards beyond those presented in the Proposed Plan. The design process should consider long term erosion, permanence, operation and maintenance, and the site setting to arrive at the final cover design. The ROD should also include additional specificity, beyond that presented in the Proposed Plan, with respect to institutional controls.*

Response: The ROD includes additional details on the conceptual design for Alternative SP-3b including cover thickness, slopes, use of drainage swales etc. The ROD also includes additional information on institutional controls consistent with the ODEQ institutional control guidance and current land ownership.

Written Comments from Kerr McGee Corporation

The Kerr McGee Corporation (KMC) submitted extensive written comments dated January 7, 2000 on the Proposed Plan, including 59 pages of comments and 151 pages of attachments. Kerr McGee's comments were divided into general headings for the White King and Lucky Lass portions of the site depending on the nature of the comment. EPA's response is organized according to these headings rather than restating the entire comment. Where a heading does not fully reflect all the specific comments under the heading EPA has paraphrased the additional comments in order to represent the comment and provide a complete response.

In general Kerr McGee's comments raise a number of valid points with respect to the technical similarities between Alternative SP-3a and SP-3b. In fact the comparative analysis of alternatives in the FS indicated that they were relatively equal for many of the criteria. In the Proposed Plan EPA identified several potential differences which are worth noting. However, these potential differences were not the primary basis for selection of the preferred alternative. As required by the NCP an alternative must first meet the threshold criterion, protection of human health and the environment and compliance with ARARs, before consideration of the other balancing criteria. It is the State's position that Alternative SP-3a would not meet state laws for disposal of radioactive material. This fact was the primary basis for selection of Alternative SP-3b over Alternative SP-3a.

I. Alternative SP-3a should be chosen as the remedy for the White King portion of the Site.

Comment: *Alternative SP-3a is the best choice because it is completely effective compared to other alternatives and at the least cost.*

Response: In order for EPA to select a remedy for a site under CERCLA it must be both protective of human health and the environment and meet all applicable and relevant or appropriate requirements (ARARs). In some cases, an ARAR may be waived if the statutory standard is met, however at this site EPA has determined that there is no basis for an ARAR

waiver. EPA disagrees that Alternative SP-3a is the best choice because it would not meet all ARARS. The Oregon Office of Energy has determined that Alternative SP-3a would not comply with state law under ORS 469.375 and OAR---. The overburden pile under Alternative SP-3a is in the floodplain of Augur Creek and the ARAR prohibits it remaining in the floodplain.

Comment: *State Energy Rules Should Not Affect Selection of Alternative SP-3a. The Rules are legally invalid and do not affect the remedy selection process at this Site.*

Response: EPA has determined that the State of Oregon Energy Rules are an ARAR for this Site. EPA submitted comments during the public comment period of the State's rulemaking process to amend its regulations addressing overburden. EPA requested that the State not adopt the proposed amendments, noting, among other things, that the regulatory amendments regarding flood plain prohibitions appeared to go beyond the statutory provisions. The State proceeded with its rulemaking process, however, and when the rules were finalized, KMC filed a petition with the Oregon Supreme Court challenging the validity of the rules. Many of the arguments included in KMC's comments are similar to those included in its legal briefs filed with the Oregon Supreme Court. The were upheld by the Oregon Supreme Court in January 2001. (Fremont Lumber Co. v. Energy Facility Siting Council, SC No. S46401 (January 11, 2001).

Comment: *The Federal Agencies Have Formally Reached the Conclusion that the Rules Are Invalid and Cannot be Used As ARARs at this Site.*

Response: See response to previous comment. The Federal Agencies have not formally reached a conclusion that the State's rules are invalid and cannot be used as ARARs. Although the Federal Agencies' comments disagreed with the State's position during the State's rulemaking process, the Federal Agencies did not challenge the rules after they were finalized. Although KMC challenged the rules in a petition to the Oregon Supreme Court, the rules were upheld.

Comment: *Even if the rules are finally accredited as ARARs, technical data support the selection of Alternative SP-3a. Alternative SP-3a would satisfy the criteria of the Rules.*

Response: The State of Oregon regulations for disposal of radioactive material prohibit disposal in the floodplain of a creek. The Remedial Investigation Report provides evidence that the overburden stockpile is located within the current and historical floodplain of Augur Creek, and therefore Alternative SP-3a, which would cap the stockpiles in their current locations, would not meet these rules.

The rules include a pathway exemption set forth in OAR 345-050-0035, which exempts certain material from the rules. In order for Alternative SP-3a to comply with the rules, it would have to meet one of the exemptions. The Oregon Office of Energy (OOE), the agency charged with administering these laws, determined that the floodplain and erosion standards apply to the overburden piles and that an exemption is not warranted because the gamma pathway set forth in OAR 3450-50-0035 is exceeded. OOE made this determination based on radium-226 concentrations from vertical borings through the piles. (Please refer to OOE's June 21, 2000 letter which sets forth the reports of sampling data.) OOE compared these concentrations to levels seen at other sites they manage, and concluded that gamma radiation at the White King overburden and protore stockpiles soil samples would result in exposures exceeding 500 millirem per year. OOE has determined that concentrations of radioactive material in the overburden and protore stockpiles at the White King/Lucky Lass Site exceed the pathway exemption and therefore are subject to the requirements of the rule.

KMC claims that the stockpile sampling data shows the bottom half of the overburden stockpile to be exempt from the rules. Based upon the available stockpile data the agencies believe that there is no clear trend in the measured values that lends any confidence toward predicting what the radium levels are in materials even relatively close to the sampled locations. The levels of radium decline and increase in seemingly random ways throughout the stockpile. This is consistent with the random nature by which soils were deposited in the stockpiles (see comment made during the proposed plan public meeting). Based on the above, it is EPA's position that there is insufficient technical data[1] to support an exemption from the rules which would be necessary for the selection of Alternative SP-3a.

Comment: *The Overburden Pile Data Support Selection of Alternative SP-3a. KMC requests that the Federal Agencies review the technical data and determine that Alternative SP-3a would meet all requirements of the Rules, should they be accredited as ARARs, and can withstand erosive forces due to flooding. In addition, when the overburden stockpile is protected with an appropriate cover, the potential for exposure is dramatically reduced and clearly excluded from the Rules.*

Response: See response to previous comment. The Agencies believe that there is insufficient data to support an exemption from the rules. As for the erosion issue given the scale of Augur Creek and of the waste piles, EPA agrees with KMC's comment that the active force of Augur

[1] The scope of the data collection during the RI was to determine the nature and extent of contamination in the stockpiles and not necessarily to determine if soils qualified for the pathway exemption which would likely require a much more comprehensive sampling effort.

Creek is insufficient to cause any large scale disturbance to the pile.

As for the issue of using an appropriate cover for the stockpiles, the State's evaluation under its rules does not consider the use of a cover or any remedial action designed to reduce radiation levels. OAR 345-050-0035 lists the conditions under which waste materials subject to the rule are to be evaluated. This rule states in relevant part:

...The Council or the Office shall base its finding on an evaluation of potential radiation exposures and effluent releases performed under the following conditions:

(1) The evaluation considers material in the form in which it exists when it is removed from the users' equipment, systems, or settling ponds prior to any dilution or remedial action designed to reduce radiation levels.

(2) The evaluation does not consider any ameliorating effects of land use restrictions, maintenance operations, or cover material at the disposal site.

The evaluation as to whether or not the rule applies at the Site must be done as if there were no cover for the piles.

Comment: *Risk Characterization and Land Use Assumptions Should Reflect Likely Risks To Support Remedy Selection. Alternative SP-3a would remediate all likely human exposure risks. To the extent that Alternative SP-3b is proposed on the basis of residential exposures, that proposal should be withdrawn because there is no support for that risk management decision.*

Response: EPA agrees that both Alternative SP-3a and SP-3b can be equally protective of human health based on the exposure scenarios presented in the risk assessment. However, Alternative SP-3b was not proposed on the basis of residential exposures or human health risks. The risk assessment is included in the Administrative Record for the Site.

Comment: *Alternative PRGs Based on Background Levels for the White King Area Should Be Selected. Kerr McGee requests that the Federal Agencies recognize these naturally occurring background levels and derive PRGs based on these levels. All relevant analysis of the remedy in the Proposed Plan should be adjusted accordingly.*

Response: Cleanup levels in the ROD were selected based on either background, applicable standards, or risk levels, whichever were higher. The statistical basis for EPA's background is documented in Jacob's Engineering *Independent Evaluation Report* dated April 10, 1988. In that

report, soil locations were included in the background data set if they were not likely to be influenced by erosion or leaching of constituents from the overburden and protore piles, regardless if they were in a mineralized zone.

The record on the disagreement between Kerr McGee and the agencies on the determination of background is reflected in the agencies comments on this subject during the Feasibility Study. These are included in the Administrative Record. EPA disagrees that the highest levels of arsenic at 1570 mg/kg or Ra-226 levels at 10.3pCi/g be used as background since these values are based on inclusion of samples which could be elevated due to their proximity to the stockpiles. EPA would like to emphasize that the cleanup approach will be guided by visual criteria to determine what is mining related waste followed by confirmational sampling and placement of a clean soil cover. The specific clean up approach is described in the ROD and will be refined during the Remedial Design and Remedial Action Workplan.

Comment: *The Cover Options with Alternative SP-3a are Equally Effective as SP-3b at Controlling Infiltration, Leaching, Percolation, and freeze thaw protection.*

Response: Alternative SP-3a has a greater surface area than SP-3b and we believe that infiltration would increase with surface area. However, EPA agrees that it may be difficult to distinguish infiltration rates, leaching, and percolation between the two alternatives using the same cover, particularly at ground water monitoring wells. We also agree that freeze thaw protection would be roughly equally between the two alternatives using the same cover. Alternative SP-3b was not proposed on the basis of being more protective of ground water quality than Alternative SP-3a using the same covers. EPA believes that Alternative SP-3b is slightly more effective and permanent considering issues other than those listed in KMC's comments. By consolidating the piles, less surface area is subject to the overall effects of erosion. It will also provide an opportunity to compact the material and place it into a more

stable configuration. It will also place the waste in a single location providing for somewhat easier maintenance and monitoring. The Help modeling analysis cited is useful for design considerations and to develop a more permanent and robust cover but does not in itself support the argument that SP-3a and SP-3b are equally effective overall.

Once a decision was made to select Alternative SP-3b over Alternative SP-3a, based on the ARARs analysis, EPA selected a cover design which represented the best balance of a number of factors including the NCP balancing criteria. In this analysis the need to establish vegetation and

minimize biointrusion were two important factors considered by EPA. Infiltration and percolation were not significant factors for this evaluation.

Comment: *Alternatives SP-3a and SP-3b Do Not Differ As to Effects of Erosion*

Response: EPA agrees that engineering design features and the comprehensive operation and maintenance plan components of the selected remedy will go a long way toward reducing erosion of the covered stockpile. Such components were also included with Alternative SP-3a. However, the addition of overburden pile material to the protore pile under Alternative SP-3b can allow more flexibility in incorporating design features to minimize erosion. Such features could include lower cover gradients, placement of lower concentration/activity materials on the top and sides of pile as sacrificial material, and compaction of relocated overburden materials to promote cohesion and armoring.

In addition, the consolidation of soils under alternative SP-3b results in less total surface area subject to erosion as compared to SP-3a. A single stockpile will be somewhat easier to inspect and maintain than two separate stockpiles. Moving the overburden pile will provide for a more geotechnically stable configuration that can be designed to blend into the adjacent terrain. The current location of the overburden pile under Alternative SP-3a is subject to erosion from Augur Creek as well as drainage originating from the White King pond.

Comment: Alternative SP-3a Would Be Reliable and Effective Considering Issues of Biointrusion. A mesh chain link fence under Alternative SP-3a is equally effective as a field fence under Alternative SP-3b in limiting access of herbivores. Whether Alternative SP-3a or SP-3b is selected, the cover should include an additional 6 inch rather than a 12 inch rock layer to control burrowing animals.

Response: The Agencies do not believe a thin cover and a chain link fence is appropriate to control biointrusion. Without continuous maintenance, Alternative SP-3A has no long-term effectiveness against biointrusion into the contaminated soils by climax plant species or burrowing animals. Furthermore, the ability to construct and maintain a chain link fence in an extreme environment as at the Mines site is questionable. It also has an undesirable visual impact. As for the cover, the selected remedy is different from the preferred remedy identified in the Proposed Plan in that an additional 12 inches of soil will be included with the cap as opposed to an additional 12 inches of rock layer. (See Section 14 of the ROD.) While a 24 inch soil cover alone would not eliminate biointrusion entirely, it would be somewhat more effective than the 12 inch soil cover under Alternative SP-3a in reducing biointrusion into the underlying stockpile

material for those burrowing animals present in the vicinity of the Site. However, a 24 inch soil cover in combination with the recompacted "clay-like" layer under Alternative SP-3b, with placement of lower activity/concentration material on the top and sides of the piles, would be effective in limiting biointrusion into the underlying contaminated stockpile material.

Comment: *Alternative SP-3a Does Not Differ From SP-3b With Respect to Maintenance. The need for maintenance is not a function merely of surface area. The level of maintenance required is not a function of thickness of the cover. A better indication is to evaluate the respective costs of maintenance. The portions of the cover that are most prone to gully propagation and therefore require the greatest amount of maintenance are those areas with the steepest slopes.*

Response: As with the other issues raised in Kerr McGee's comments maintenance costs were not a criteria which led to the selection of Alternative SP-3b over SP-3a. Alternative SP-3b has less overall surface area and intuitively maintenance costs should be somewhat less all other factors being equal. This seems to be supported in the FS Volume V Table 2-4 where Annual Cover O&M for Alternative SP-3a is higher than Alternative SP-3b regardless of the cover type. We agree that these differences become less with consideration of the higher capital costs of Alternative SP-3b and the long term costs for perpetual care. Despite the estimated similarities in maintenance costs between the two alternatives EPA believes that Alternative SP-3b can be constructed in such a way to minimize those factors, such as slopes , which may lead to higher maintenance costs. These factors will be considered and maximized during the remedial design.
Comment: *There Is No Unacceptable Risk From Radon Emanation. The Proposed Plan appears to favor Alternative SP-3b over SP-3a because SP-3b would purportedly offer greater protection against risks attributable to radon exposure in soils.*

Response: While radon reduction is a potential benefit of a thicker cap it is not the risk driver nor the basis for selection of alternative SP-3b in the ROD. The selection of a cap design is also not based on potential risk from radon emanation. However, radon flux was not measured during the RI and the Administrative Record documents the Agency's concerns with the lack of this information. Radon emissions should still be a consideration because the material has the potential to exceed established criteria. Compacting and configuring the material in Alternative SP-3b will help reduce the potential to elevate radon.

Comment: *Alternative SP-3b Is not Preferable to SP-3a on the Issue of Wetlands Protection. The value of creating a wetlands does not correspond to the nine NCP criteria. Removal of the pile would not result in the establishment of wetlands acreage in all of the footprint. The Proposed*

Plan cites Executive Order 11990 as a basis for preferring SP-3B over SP-3A, but it is not a promulgated regulation and therefore not an ARAR.

Response: The Procedures on Floodplain Management and Wetlands Protection are set forth at 40 CFR Part 6 Appendix A and establish agency policy and guidance for carrying out the provision of Executive Order 11988 "Floodplain Management" and 11990 "Protection of Wetlands." Although these provisions are contained in the Code of Federal Regulations, EPA agrees that they do not meet the definition of an applicable or relevant and appropriate requirement (ARAR) under CERCLA. This citation has been deleted from the ROD. Please note, however, that the deletion of the citation does not effect the analysis of selecting Alternative SP-3B over SP-3A given that Alternative SP-3A does not meet the threshold criteria used under CERCLA to select a remedy.

Comment: *Alternative SP-3a is Geomorphically Stable and Would Not be Affected by Flooding Events.*

Response: As stated in a previous response, the RI provides evidence that the overburden stockpile is within the floodplain of Augur Creek and potentially subject to erosion. U.S. Forest Service personnel have also observed this to be the case during the spring.

Flooding potential and velocity calculations were performed for the in-pit disposal option, Alternative 4. However, there is insufficient analysis to determine the geomorphic stability of Alternative SP-3a other than observations associated with unquantified return intervals of flooding events in the Auger Creek Watershed. During flooding of Auger Creek in January 1999, a high water mark was observed on the overburden pile but not on the protore pile.

Under Alternative SP-3a, the location of the overburden pile greatly restricts the Augur Creek floodplain by confining Auger Creek to a small channel. The overburden pile is directly in the path of the original stream channel and is approximately perpendicular to flood flow if the stream jumps its present channel. Geomorphic processes have already eroded the overburden pile and moved overburden material several hundred feet down the valley. No such erosion is evident on the protore pile. In addition, it is important to remember that a significant amount of water is diverted around the high wall and is channeled to the area just below the protore pile. This channel has been observed as flowing at near capacity under peak flow conditions. This channel drains into the meadow and flows toward the overburden pile and combines with the Augur Creek channel. The volume from these drainage areas can add a significant amount of water to

Augur Creek and is one of the reasons why erosion has occurred on the overburden pile when none has been observed on the protore pile. The Forest Service has estimated the flows from these drainages increase the Augur Creek flow by as much as 75% at these times. Another contribution to the flows by the overburden pile is the water leaving the pond area. Water flows out of the culvert and behind the overburden pile as well as overland, across the road and then empties into Augur Creek. It is important to note that erosion also occurs on the backside of the overburden pile from water flowing in a man-made channel from the pond. So, there is erosion occurring on two fronts of the overburden pile which would continue under Alternative SP-3a. The same would not be the case for Alternative SP-3b since the consolidated stockpile will be moved out of the floodplain of Augur Creek.

Comment: *Alternative SP-3a Provides Greater Protection Against Short Term Air Quality Impacts. This factor should be added to the evaluation of remedies.*

Response: Short term effectiveness in the context of the nine criteria analysis considers short term risk that may be posed to a community during implementation of an alternative, potential impacts on workers during remedial action and the effectiveness and reliability of protective measures, and potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation. These factors were considered in the comparison of alternatives section of the Feasibility Study and ROD. EPA recognized that Alternative SP-3b involves the excavation and movement of 230,000 cubic yards of material. However, the development and implementation of a site specific health and safety plan and implementation of dust control procedures will ensure adequate protection for workers and impacts to off-site areas during the remedial action. An approved dust control program will minimize off-site impacts. In addition, given the remoteness of the Site, there is little chance for short-term impacts to residences or a potential to impact Lakeview's particulate matter (PM10) levels.

Comment: *Alternative SP-3a Is More Cost Effective Than Alternative SP-3b. Because it also costs less than the others, CERCLA requires that this remedy be selected.*

Response: Alternative SP-3a does not meet the threshold criteria for compliance with ARARS According to the NCP, each alternative must meet the threshold requirements in order to be eligible for selection. Only after it has been determined that ARARS can be met and adequate protection of human health and the environment can be achieved is it appropriate to consider cost effectiveness. Alternative SP-3b meets the threshold requirements and is cost-effective.

II. Lucky Lass - Scope of Reclamation

Comment: *The Proposed Plan should be revised to eliminate the suggestion that a residential risk scenario is likely at Lucky Lass or that it is a basis for remedy selection. In situations where the government has quantified radionuclide levels for risk analysis, the level of radionuclides in Lucky Lass materials is lower than levels EPA has concluded in other contexts as acceptable for unrestricted, residential use.*

Response: The ROD includes the following language: "There is no current residential use at the Site and the likelihood that the area would be used for residential use in the near future is small given the current land ownership and remote location of the Site. However, because of the long-lived radionuclides (decay rate from days to 1000s of years) at the Site, the baseline risk assessment evaluated potential risk under a residential use scenario which includes workers, recreational users (also used to represent potential exposure to a trespasser), and residents." The Oregon Cleanup regulations, which are ARARs for the selection of response actions, require that the excess cancer risk be no greater than 1×10^{-6} for each individual carcinogen, and therefore are more stringent than the NCP. These regulations form the basis for the selected remedy at Lucky Lass.

Comment: *By imposing institutional controls for the overburden pile and not indicating to the public that the whole area and offsite pose identical natural risks, the public would be mislead [sic] to believe that the overburden pile presents a unique elevated risk that nearby areas do not.*

Response: The remedial actions described in the ROD addressing the Lucky Lass mine area include removing soils containing arsenic and radium-226 that exceed protective levels for a recreational user and requiring institutional controls to restrict future residential use of the stockpile material and prohibit groundwater use and well drilling within the footprint of the stockpile.

Institutional controls may be used as a component of a remedy to prevent or limit exposure to hazardous substances, pollutants, or contaminants. Institutional controls, however, are not intended to make a statement about on-site versus off-site conditions or risks. EPA doesn't expect that the public will be misled by use of institutional controls as part of the remedy. The public may find information regarding the risks posed by the surrounding area by reviewing documents in the Administrative Record regarding the naturally occurring mineralization that is

found throughout the surrounding area of the White King/Lucky Lass Site.

Comment: *CERCLA Does Not Authorize the Government to Require Response Action for Levels of Substances That Do Not Exceed Naturally Occurring Levels. CERCLA has been interpreted and implemented in numerous ways [e.g., Remedial Investigation guidance, NPL delisting decisions, liability determinations, other federal agency practices, CERCLA Section 104(a)(3) and (b)] to show that response actions addressing substances at naturally occurring levels are unwarranted and unauthorized. The Lucky Lass remedy should not be selected without consulting the appropriate federal agencies and EPA Headquarters.*

Response: The White King and Lucky Lass Mine Sites will be remediated because of arsenic and radium levels in overburden that exceed acceptable risk levels. Section 104(a)(3) of CERCLA allows response actions in response to a release or threat of release of a naturally occurring substance in an altered form. At White King/Lucky Lass, the stockpiled materials containing radionuclides and arsenic were created solely as a result of mining operations at the Site. Undisturbed soils at the Site were excavated and stockpiled for mining purposes. They are currently present at the Site in an altered form. The conditions at the Site are distinct from the examples posed in the comment. As provided under CERCLA, EPA is not taking response actions at the Site where any naturally occurring substance is located where it is naturally found and in its unaltered form or altered solely through naturally occurring processes or phenomena. With respect to consulting with EPA Headquarters regarding the remedy selected for the White King Lucky Lass Site, EPA has guidance clarifying when a site is appropriate for review by EPA's Remedy Review Board and the Site does not qualify for such review. However, EPA headquarters did review the draft Proposed Plan prior to the public comment period.

III. Other Issues in Proposed Plan and Record

Comment: *The Proposed Plan should be revised in several respects for factual statements of Site history and the PRPs*

Response: The content and amount of detail in the ROD addressing PRPs at the Site is consistent with EPA guidance. Additional issues associated with determining the liability of PRPs is beyond the scope of the Proposed Plan and ROD. Likewise, it is inappropriate for the Response to Comments to go into legal details to respond to the liability arguments against other entities set forth in the KMC's comments.

Comment: *The Proposed Plan and other portions of the administrative record mention previous efforts to study the Site by the USFS. However, those efforts do not meet NCP requirements for data integrity or validity.*

Response: The Draft Environmental Impact Statement (DEIS) was prepared by the Forest Service to comply with the requirements of CERCLA and the National Environmental Policy Act of 1969 prior to EPA listing the site on the NPL. This results of this study were used, as appropriate, to support Site characterization efforts and an overall understanding of the site. All data considered by EPA as a basis for selection of the remedy met NCP requirements for data integrity and validity, where such requirements applied.

Comment: *KMC requests that the White King Mine pH PRG be revised to the pH range from 6.0 to 9. Decreasing the lower limit of the PRG pH range from 6.5 to 6.0 will not adversely affect the aquatic environment at White King mine.*

Response: The applicable State surface water standard for the White King pond is found at OAR 340-41-922 and OAR 340-41-925 (d) (B). These standards require the pH to be between 7 and 9. It is currently unclear if this goal is achievable for the White King pond. The monitoring described in the ROD will assess the risks and feasibility of environmental protection for the proposed beneficial uses (aquatic habitat). Once the beneficial use for the White King pond is firmly established and the pond neutralization is implemented EPA will re-evaluate the pH remediation level.

Comment: *The Proposed Plan contains numerous other statements that should be corrected and that should not be used as a basis for choosing Alternative SP-3b. To the extent the proposed remedy is based on these mistakes, the Proposed Plan should be reconsidered in light of the following corrections identified by quoting the Proposed Plan:*

Response: The comment is noted and where appropriate these corrections have been reflected in the ROD. However, such minor revisions do not impact the basis for selection of the remedy. Remediation goals for the pond sediment will be established after a period of monitoring and study as described in the ROD. This action will be documented in an ESD or ROD amendment.

Appendix D

White King/Lucky Lass Uranium Mines Cleanup Project

Fremont National Forest
Lakeview Ranger District
(Lake County, Oregon)

Forest Plan Amendment # 22

This non-significant, site-specific amendment to the Fremont National Forest Land and Resource Management Plan (Forest Plan) creates a new Management Area 17 – White King/Lucky Lass Uranium Mines CERCLA Remedy.

Emphasis – This MA 17 will emphasize protecting the integrity of the CERCLA Remedy for the White King/Lucky Lass Uranium Mines on the Lakeview Ranger District of the Fremont National Forest. (Section 12 of Final ROD)

Goal – The goal will be to provide institutional controls needed to implement the "Selected Remedy" as discussed in the Record of Decision - White King/Lucky Lass Site. (Section 12 of Final ROD)

Discussion – This MA consists of approximately 240 acres around the White King and Lucky Lass Mines, including the White King pond. Uranium mining activities occurred at the White King and Lucky Lass Mines during the 1950s and 1960s and resulted in current Site conditions, including water-filled excavation pits (ponds) and stockpiled mineralized waste rock/materials. The Site was included on the National Priorities List (NPL) in 1995, and includes both private property and National Forest System land. EPA, with Forest Service concurrence, selected a remedy for the Site pursuant to the Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA), 42 U.S. Code 9601 et seq. As discussed in the ROD, the remedy will excavate and consolidate the stockpiled material at the White King Mine, including portions of the stockpile at the Lucky Lass Mine. The consolidated stockpile (referred to as the mine waste repository) will be capped with a two-foot soil and vegetative cover and will be located primarily on National Forest System land. The water-filled excavation pit at the White King Mine, which is also partially located on National Forest System land, will be monitored and in-situ neutralization will be continued to maintain a neutral pH level. White King pond sediments will be monitored and further studied. Institutional controls will also be implemented.

Prescriptions –

Mineral Entry.

Area will be withdrawn from mineral entry. The withdrawal includes 240 acres of federal lands specifically described as:

T. 37 S., R 18 E., WM
Section 25: NW ¼ NE ¼
T. 37 S., R 19 E., WM
Section 30: NW ¼ NE ¼, NW ¼ SE ¼, N ½ NW ¼, and SE ¼ NW ¼

Due to the anticipated 100-year plus life-cycle of the mine waste repository, it would be expected that the 20 year mineral segregation established by Public Land Order (#6990) would be further extended for additional 20-year periods.

Prohibitions

- Residential structures or use
- Drinking water well drilling
- Any permanent structures
- Permanent recreation sites (e.g. campgrounds) and uses (e.g. swimming in White King pond)
- Removal of stockpiled material
- Agricultural activities
- Any other use that would impact the integrity of mine waste repository and Lucky Lass stockpile, including grazing on stockpiles and off-road vehicle use

Timber Harvest

There is no scheduled timber harvest on these lands. Harvest activities within this 240 acres only be permitted that protect the CERCLA Remedy.

Fire Suppression Needs

Water from the White King and Lucky Lass ponds may be used for fire suppression needs under the following constraints:

- Use of the White King Pond is preferred over the Lucky Lass Pond
- Water should only be removed from the deepest portions of the ponds
- Care should be taken to avoid disturbing pond sediments when removing water from the pond(s)

Access

Access will be restricted by the presence of a fence or other physical barrier surrounding the White King pond and mine waste repository in order to prevent exposure to and disruption or use of the stockpiled materials and White King pond sediments. As discussed in the ROD, access restrictions at the White King pond may be eliminated in the future depending on success of neutralization and actions to address the risks associated with the pond sediments while access restrictions at the Lucky Lass stockpile will be short-term only lasting until completion of the remedial action. The fence should have gates that can be locked at all times. Warning signs will be posted every 200 feet along the fence/barrier stating the hazards, who to contact, and advising people not to remove or disturb any of the stockpiled material.

Adjacent Property Owners

The adjacent property owners will be contacted annually to discuss the land use restrictions and potential future uses or property transactions that could affect this management area.

Determination that the Forest Plan Amendment is Not Significant Under National Forest Management Act (NFMA)

I have determined that this is not a significant Forest Plan amendment under the NFMA implementing regulations [36 CFR 219.10(f)]. The following factors from Forest Service Handbook (FSH) 1909.12 were considered in this determination

Timing - *Identify when the change is to take place. Determine whether the change is necessary during or after the plan period (the first decade) or whether the change is to take place after the next scheduled revision of the forest plan. In most cases, the later the change, the less likely it is to be significant for the current forest plan. If the change is to take place outside the plan period, forest plan amendment is not required.*

This amendment is to be implemented immediately and will be necessary for the life of the remedy --- 100 plus years. This duration is needed to provide the institutional controls to implement the "selected remedy".

Location and Size - *Determine the location and size of the area involved in the change. Define the relationship of the affected area to the overall planning area. In most cases, the smaller the area affected, the less likely the change is to be a significant change in the forest plan.*

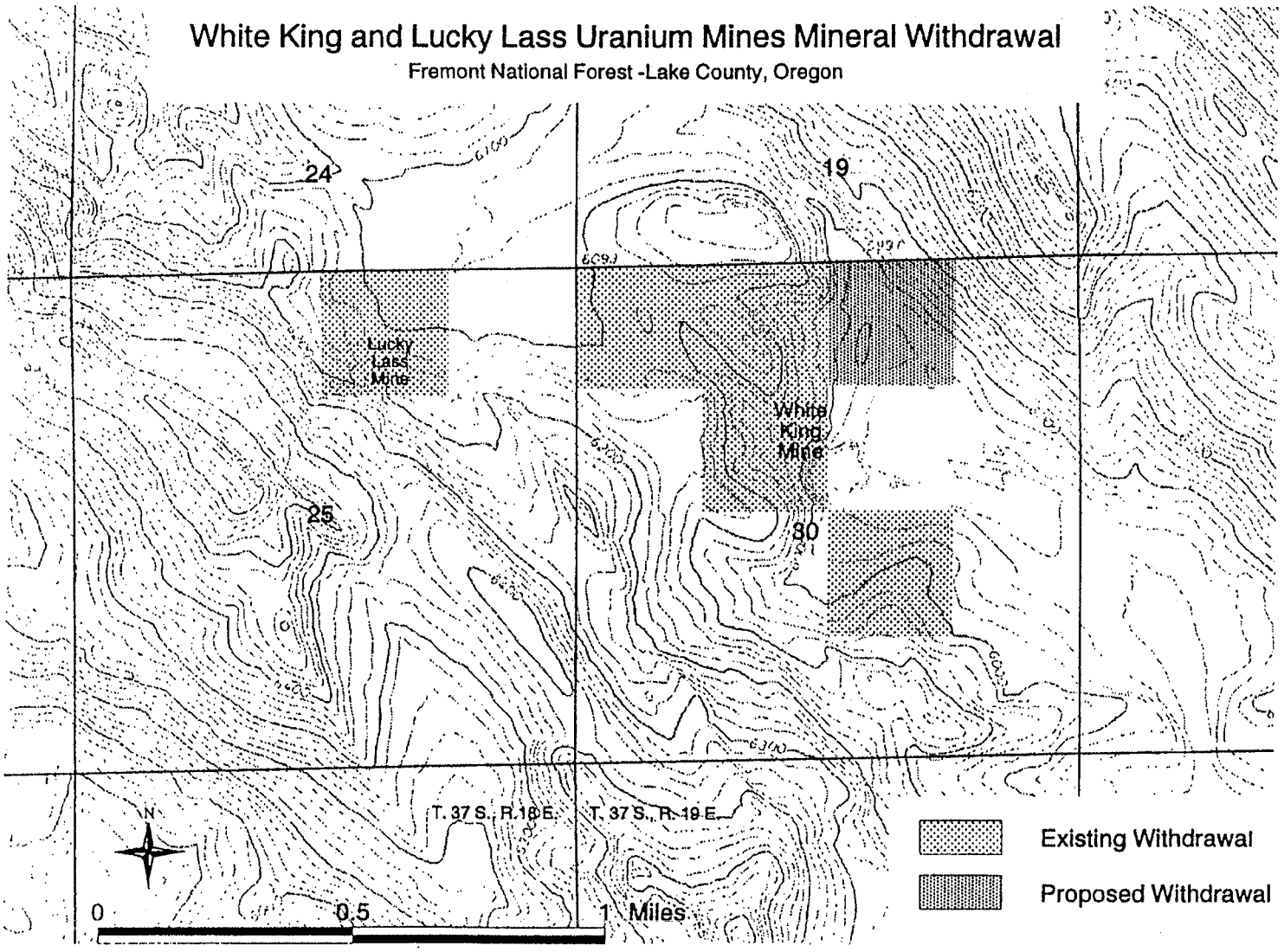
This amendment only affects 240 acres out of the total forest acreage 1,198,301 acres. This is only approximately 0.02 per cent of the Fremont National Forest. (See attached Map from the Environmental Assessment for the Addition to the White King and Lucky Lass Uranium Mines Mineral Withdrawal, dated March 2001).

Goals, Objectives, and Outputs - *Determine whether the change alters long-term relationships between the levels of goods and services projected by the forest plan. Consider whether an increase in one type of output would trigger an increase or decrease in another. Determine whether there is a demand for goods or services not discussed in the forest plan. In most cases, changes in outputs are not likely to be a significant change in the forest plan unless the change would forego the opportunity to achieve an output in later years.*

Because the project specific area is small (240 acres) relative to the total forest acres, the long-term relationships between the levels of goods and services will not be changed.

Management Prescription - *Determine whether the change in a management prescription is only for a specific situation or whether it would apply to future decisions throughout the planning area. Determine whether or not the change alters the desired future condition of the land and resources or the anticipated goods and services to be produced.*

The management prescription is only for the 240 acres. These prescriptions applied to this localized area will not affect anticipated forest wide goods and services to be produced.


White King and Lucky Lass Uranium Mines Mineral Withdrawal
Fremont National Forest -Lake County, Oregon
24
19
Lucky Lass Mine
White King Mine
25
30
T. 37 S., R.18 E.
T. 37 S., R. 19 E.
N
0
0.5
1 Miles
Existing Withdrawal
Proposed Withdrawal

APPENDIX E

CONCURRENCE LETTERS

WHITE KING/LUCKY LASS RECORD OF DECISION

United States Department of Agriculture
Forest Service
Pacific Northwest Region
P.O. Box 3623
Portland, OR 97208-3623
333 S.W. First Street
Portland, OR 97204

File Code: 2810

Date: September 28, 2001

Mr. Charles E. Findley
Acting Regional Administrator
U.S. Environmental Protection Agency
Region 10
1200 6th Avenue
Seattle, WA 98101

Re: White King/Lucky Lass Mine Site

Dear Mr. Findley:

The United States Department of Agriculture Forest Service (Forest Service) concurs with the remedy selected in the September 2001 Record of Decision (ROD) for the White King/Lucky Lass Superfund Site. A component of the ROD made effective by my concurrence is Fremont National Forest Plan Amendment #22, a copy of which is enclosed. The purpose of the Forest Plan Amendment is to protect the integrity of the remedy selected by the ROD.

The Forest Service is pleased with the selection of a remedy that will protect human health and the environment. We look forward to a continued cooperative and productive relationship with the EPA and the state agencies during remedy implementation.

Sincerely,

Harv Forsgren

HARV FORSGREN
Regional Forester

Enclosure

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Eastern Region
700 SE Emigrant
Suite 330
Pendleton, OR 97801
(541) 276-4063 Voice/TTY
FAX (541) 278-0168

September 26, 2001

Mike Gearheard
Director of The Office of Environmental Cleanup
U.S. Environmental Protection Agency, ECL-117
1200 Sixth Avenue
Seattle, Washington 98101

Re: White King/Lucky Lass Uranium Mines Site
Record of Decision

Dear Mr. Gearheard:

The Oregon Department of Environmental Quality (DEQ) has reviewed the draft Record of Decision, for the above referenced project. I am pleased to advise you that DEQ concurs with the selected remedy recommended by EPA. I find that this alternative is protective, and to the maximum extent practicable balances the feasibility factors. Accordingly, it satisfies the requirements of ORS 465.315 and OAR 340-122-040 and 090.

It is understood that the White King Pond will be further evaluated under this Record of Decision. Additional decisions and requirements for the White King Pond may result from this effort particularly with respect to protecting beneficial uses and with respect to potential sediment exposures. DEQ is looking forward to working with EPA during design and implementation to resolve these issues.

If you have any questions concerning this matter, please contact the project manager, Mr. Brian McClure, with the Eastern Region Cleanup Program at (541) 298-7255 ext. 32.

We look forward to the successful implementation of this remedy.

Sincerely,

for Joni Hammond
Eastern Region Division Administrator

JBH:BMc
Cc: Terry Hosaka, DEQ
Bill Adams, EPA
Kurt Burkholder, DOJ

September 26, 2001

Mike Gearheard
Director of the Office of Environmental Cleanup
U.S. Environmental Protection Agency, ECL-117
1200 Sixth Avenue
Seattle, Washington 98101

Re: White King/Lucky Lass Uranium Mines Site Record of Decision

Dear Mr. Gearheard:

We have reviewed the draft Record of Decision, for the White King/Lucky Lass Uranium Mines cleanup project. The Oregon Office of Energy concurs with the remedy recommended by EPA. I find this alternative to be protective, as well as practical. I believe it meets the requirements of the applicable disposal standards of the Oregon Energy Facility Siting Council contained in Chapter 345, Division 50.

We understand that the White King Pond will be further evaluated under this Record of Decision. Additional decisions and requirements for the White King Pond may result from this effort particularly with respect to protecting beneficial uses and with respect to potential sediment exposures. OOE is looking forward to working with EPA during design and implementation to resolve these issues.

If you have any questions concerning this matter, please contact me at 503.378.6469. We look forward to working with you and your staff on the final site cleanup.

Sincerely,

David A. Stewart-Smith, Administrator
Energy Resources Division

Cc: Mike Grainey, OOE
Bill Adams, EPA
Kurt Burkholder, DOJ